UNIVERSITY OF CALIFORNIA.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

167-177 TIMES BUILDING, NEW YORK.

Established 1874. Incorporated 1889

W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T. COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.
WM. A. ROSENBAUM, Editor Patent Department.
WALTER T. HUNT, Advertising Department

New England Office, 8 Cook Building, Boston.
Western Office, 39 Mallers Building, Chicago.
Philadelphia Office, 31 City Trust Building.

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(Including Postage in the U. S., Canada or Mexico.)
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The New Brunswick Exhibition. THE reports from St. John, N. B., show that the greatest interest is taken there in the Electrical Exhibition to begin on July 22, and there is every reason to believe that it will be a success and helpful in the way of stimulating electrical development and trade. Mr. Knudson has worked hard, and has done his best to secure for American electrical industries a creditable representation. The opportunity is a good one for cultivating new commercial relationships and will, we trust, be made the most of by manufacturers.

The Electric Light Convention. SECRETARY GARRATT has now issued what may be regarded as his final bulletin relative to the arrangements for the Niagara Falls Convention of the National Electric Light Association, and it will be seen that a very attractive programme is laid out. We trust that all of our readers who are in any way interested in the welfare of the Association will attend to the requests made by Mr. Garratt, and will also see to it that by their personal participation they help to render the meeting the most profitable and enjoyable ever held by the Association.

Investments in Electric Lighting. PROF. BARRETT, on returning home from Chicago after his recent tour of inspection, made an interesting report on the state of electrical affairs throughout the country. He was naturally confirmed in his belief that Chicago should own and operate its own electric light plant, but he was willing to admit that in most cities private enterprise had been found quite equal to the task of providing the necessary plants. The list he gave of new and enlarged installations, as quoted in our columns, is a striking exemplification of the magnitude and solidity of electric lighting investments.

Government Telegraphs in Spain. Last week we had something to say relative to the arguments advanced by Prof. R. T. Ely in favor of government telegraphs. In our present issue, Mr. H. L. Webb has an excellent article, written from personal experience, on the working in Spain of one of these much admired government systems. Mr. Webb writes without prejudice, and has a good word to say for other government telegraph services in Europe; but he presents a terrible indictment against governmental control, so far as Spain is concerned. The service is bad, the lines are poorly built and wretchedly maintained, the employés are underpaid and discontented, and the public is disgusted. As might be expected, the government abuses its monopoly, which it utilizes largely for political purposes.

Horse-Power Characteristics. THE electrical engineer is so frequently called upon to estimate the power of machines, that some ready means of ascertaining such values will be welcomed by not a few. An excellent aid of this nature is that furnished in the chart of horse-power characteristics prepared by Mr. W. F. D. Crane. He has found it of such use in his own work that he is desirous of extending its benefits to others. While the chart is of general utility, it will be found of special benefit to those engaged in electrical traction operations where the power required to drive cars varies with such great frequency, and where the individual calculations to convert from electrical to mechanical horse-power would entail a large amount of labor and loss of time. We are confident that Mr. Crane will receive the thanks of many for this timely piece of work.

The Safety of Electricity. THROUGH the courtesy of Dr. Schuyler S. Wheeler we are able to present some figures as to the number of deaths last year in this city from accidents of varying nature. It appears that out of a total of 1,258 accidental deaths only five were due to electricity, and those more of a "careless" than an "accidental" character. This showing is most remarkable when we remember how the multitudinous electric wires ramify in every direction; yet reading some of the daily papers one would easily and readily believe that electricity was responsible for the whole 1,258. Much can yet be done to improve the conditions of electric service, and under the able and conscientious direction of Dr. Wheeler himself much is being done; but it is gratifying to find that even under the methods hitherto in vogue life has been so safe. It will be interesting to observe what the betterment, if any, in this respect will be when more of the wires are placed underground.

Bucket Shop Litigation. IT would would seem as though the courts in the different States were anxious to muddle and befog the minds of those interested in the question whether bucket shops are or are not entitled to stock ticker service. While in New York we have recently seen decisions against the bucket shops, and laws passed declaring those institutions as unlawful as any other gambling hells, three Illinois judges have just denied a motion to dissolve the preliminary injunction that prevents the Chicago Board of Trade from withholding its quotations from the shops. The judges agree in the opinion that while the Board continues to furnish quotations to any one it must furnish them to every one willing to pay for them. In other words, the market quotations are public property, and one of the judges remarked that he thought it quite possible that news gatherers might compel the Board to admit them to get the news as to the prices of stocks.

'A Friend in Need." AN article in our columns this week on the use of electric motors in printing offices cites the interesting episode which occurred at Washington a couple of weeks ago, when the well-known *Star* of that city, suffering from the disablement of its engine room, fell back for help in its emergency upon C & C electric motors and with them was able to get out its usual large editions. The quickness with which the installation was made, and the promptness with which the motors settled down to their work and kept a big newspaper office going, speak volumes for the general availability of electric power. It is such an example as this that will teach the public the value of the electric motor. The *Star*, which deserves much praise for the enterprise and energy that it displayed under these trying conditions, is generous in its commendation of the motor and of the manner in which it more than realized the expectations formed of it.

Newspaper Electricity. RIDICULING the idea that prolonged agony may attend the death of a man killed by electric shock, the *New York Herald* in an editorialette says: "Well, the other day a horse trod on a live wire, and in the fiftieth part of a wink, 'his eyes was sot.'" Suppose they were? What has that to do with the question? Some one when asked whether he had had his portrait done by Sir Edwin Landseer, the great animal painter, asked in reply: "Is thy servant a dog that he should do this thing?" What may happen to horses and dogs has its own interest, but it has very little to do with the effect of the current on human beings; while even among men there are the widest differences of capacity. One man's meat is another's poison. The editor of the *Herald* might be able to drink but one glass of whiskey with impunity while the editor of the *Voice* might be able to "get away" with a barrel; but that inequality of resistance does not settle the prohibition question.

Electric Boston. WE remember hearing a lecture once by Dr. Joseph Cook, in which that brilliant divine expatiated on the wonderful results attending the presence in New England of peculiar electric conditions. If our memory serves us aright, the reverend doctor had discovered the existence of an electric cloud over Boston, so that the ambient air was always charged with influences that gave to the Bostonian his special vivacity, intelligence and nervous intensity. The theory being true, though slightly unscientific in its expression, it is hardly to be wondered at that Boston has shown herself so highly appreciative of electrical enterprises and now has declared her intention of becoming, as soon as possible, the most practically electrical city in the world. Her telephonic and electric light interests, great as they are, sink into a subordinate place in view of the step just taken to equip her street railway system wholly by electricity. It is a splendid triumph for Boston that the work is to be done by her own local skill and capital. We admire the faith of the men who take this new departure, and we do not hesitate to avow our belief and absolute conviction that the results obtained will in every way justify them.

New Brush Alternating Apparatus. IN the Brush Electric Company's alternating system, which is fully illustrated and described in our columns this week, we have a marked departure from the forms and methods that have already become well known in this new field, so rapidly developed by American genius and enterprise. The chief novelty lies in the construction of the generator, in which it has been sought to avoid as much as possible the use of iron subject to change of magnetic polarity, resulting in an armature entirely free from magnetic material. The type here adopted is in direct analogy with the latest constructions adopted abroad by Ferranti and Mordey, the reasons for which were so graphically shown by the latter designer in a paper read before the London Institution of Electrical Engineers, of which we gave an abstract at the time. The construction adopted in the stationary sectional armature permits of a ready examination of the machine at all times, and we are informed that actual runs have been made with single armature coils removed from the machine while in operation. We note also the tendency to the increase in the voltage carried on the circuits, for which there seems to be ample precedent. The details of the apparatus have evidently been very carefully thought out, and give proof of much ingenuity and fertility.

Burning of Armatures. MANY capitalists who would prove desirable customers and who fully appreciate all the advantages to be gained by the introduction of an electric light plant in their town or their factory, are deterred from purchasing through a false idea that the various systems are still crude and imperfect, and that all profits will be swallowed up in the item of repairs, more especially to the revolving portion of the dynamo. That there is no reasonable foundation for such a belief is forcibly shown in several circulars lately issued by leading parent companies stating where their respective electric light systems, both arc and incandescent, have been in constant operation during the past three to six years without expense for repair to any part of the dynamo, the name of the owner of the plant being given in each case cited. This result might appear the more remarkable when we take into consideration the improved methods of manufacturing and the increased efficiency of machines now sent out over those sold five years ago, when much of the apparatus on the market was crude and its operation more or less unsatisfactory. Yet crude and imperfect as they were, some of the first machines installed are still in operation, having yielded good profits from the start, while in other instances the types first produced have proved so good that it has hardly been worth while to modify them at all

Electrical Horse-Power Characteristics.

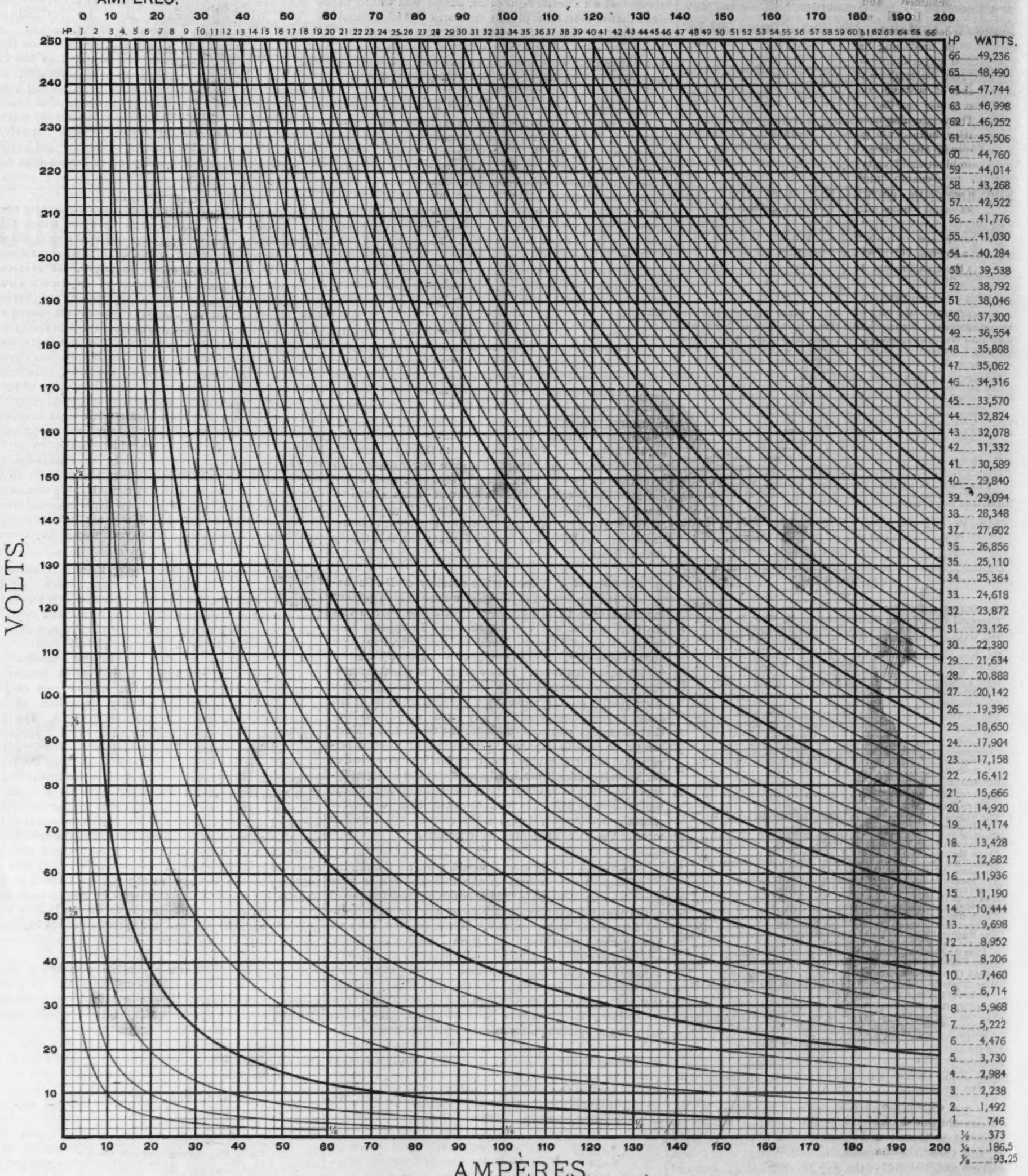
BY W. F. D. CRANE, E. E.

In his work on dynamo electric machinery, Prof. Silvanus P. Thompson shows how curves may be drawn across the characteristic diagram of a dynamo, which shall represent graphically and at a glance the electrical horse-power corresponding to the volts and ampères at the intersection of the characteristic curve, and these additional curves he there denominates electrical horse-power one of the facts which is first learned by every student of applied electricity, viz., that 746 watts equal one horse-power. In the same manner, for two horse-power the number of watts will be 2×746, or 1,492; for 3 h. p., 2,238 watts, etc. To express the operation by a formula—

$$\frac{C\,E}{746} = \text{h. p.}$$

It is patent that there is an infinite number of values to C and E, the product of which will be 746, 1492, 2238, 66 h. p. For convenient reference, the number of watts corresponding to their respective horse power is given at the right of the diagram.

The object of such a series of curves and the uses to which they may be put will be obvious at first sight. Instead of requiring the time and labor necessary to plot a series of curves across the diagram containing the characteristic of a dynamo, or motor, reference to this set will give immediately the power corresponding to the volts and ampères at any point upon the characteristic curve.



CRANE'S TABLE OF ELECTRICAL HORSE-POWER CHARACTERISTICS.

characteristics; and Mr. Gisbert Kapp, in his "Electric Transmission of Energy," makes use of these same curves, commenting on their ingenuity and convenience as an aid to the graphic solution of motor problems.

To produce these characteristics one has simply to be acquainted with the fundamental unit of electric power, the watt, or the equivalent product of one ampère flowing under a difference of potential of one volt; and also with etc. If such values be determined, and points found upon a diagram drawn to a scale of volts and ampères, a curve may be drawn through such points which will permanently and graphically preserve the quotients $\frac{C\,E}{746}$ for future use and reference. This the writer has done, as seen in the accompanying set of horse power curves, which cover the calculations from one-eighth to Their application, however, in connection with a characteristic diagram is simply one example of their usefulness and serves but to suggest other connections in which they are equally applicable.

Cases requiring the calculation of the electrical horse-power are apt to enter with more or less frequency into the experience of every electrical engineer. It is a feature of some efficiency tests of dynamos, motors, of stor-

age and other batteries; and there is many a case where the operation has to be oftentimes repeated. By its determination, the capacity of engine necessary to drive a dynamo of given size—due allowances being made for the power consumed in friction, mechanical losses, etc.—is readily found from the number of watts or the output in current and E. M. F. In the calculations of a motor designed for a circuit of constant potential the current, or, if a constant current circuit, the E. M. F. required to develop the requisite horse-power, introduces as a first step the electrical horse-power to be consumed and its corresponding number of watts. In all electric power measurements, whether to determine the power lost through resistance, expended in producing light or heat, and even in some mechanical experiments where calculations are made in watts or read direct, from the nature of the unit employed, the number of watts is computed from which the electrical horse power can be subsequently determined, if desired. There are also occasions when for inspection, approximation, curiosity or general information it is desired to discover at the moment the power corresponding to a given combination of volts and ampères, whether it be in relation to dynamo, motor, resistance or battery, and this it is within the province of these curves to do with the aid of small mental effort, without figuring and often with an appreciable saving of time.

The curves are computed within the limits of 250 volts and 200 ampères, but it will be seen that this in no way restricts their usefulness to the range within these figures. To illustrate their practicability and convenience let us take for examples some of the cases which come into the practice of every day. I hear, for instance, that the Manchester dynamo has a capacity of 130 ampères and 100 volts. What electrical horse-power does that represent and what is the corresponding number of watts? I follow the line marked 130 ampères until it meets with the line of 100 volts and find that the point of intersection falls between the characteristic curves of 17 and 18 h. p. By subdividing along a normal the space intervening between these two curves, I find that the electrical output of this machine is equal to 17.4 h. p., and at the right of the diagram I see that 17 h. p. is equal to 12,682 watts, 17.4 h. p. is then equal to about 12,980 watts, which is sufficient for my purpose. Suppose, again, that there is a battery that, under certain conditions, will give an E. M. F. of 85 volts and 70 ampéres. What is the power here available for motive purposes? By the same process as above, we find 8 h. p.

I am about to design a 15 h. p. motor that will receive its power from a storage battery. The available E. M. F. is 180 volts. At full load what current must I provide for in my calculations as to size of wire, etc.? Here we have the E. M. F. and horse-power given, to find the current. Find the intersection of the 15 h. p. characteristic with the line of 180; the current is seen to be 62 ampères.

Arc light circuits of 2,500 volts are dangerous to life. Taking the current at 10 ampères and assuming that a man receives the full current, what power is concentrated in the shock that kills? In this case we take one-tenth of the E. M. F., or 250. Two hundred and fifty volts and 10 ampères equal 3.35 h. p., and 10 times this equals 3.35 h. p., as the power corresponding to 2,500 volts and 10 ampères.

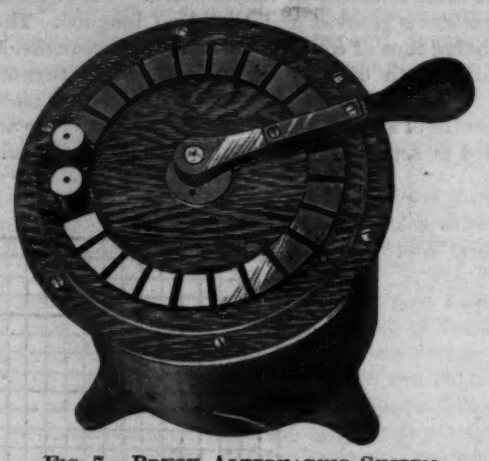


FIG. 7.—BRUSH ALTERNATING SYSTEM.

A test for the benefit of prospective stockholders is being made of a new dynamo from which great results are predicted. Seven hundred and fifty lamps are said to be burning, and the instruments read 400 ampères and 110 volts. The engineer states that the engine is certainly not working over 40 h. p. This gives over 18 lamps per h. p. of engine, and stock in the new concern is high. I am a layman, and know not how a horse-power is obtained, but my set of curves tells me that something is wrong, since it would require almost 60 e. h. p. to produce the volts and ampères shown by the instruments.

Again, I am on a trial trip of an electric car and can read the instruments which are placed in circuit to show the variations in the current and E. M. F. on the levels and over the grades. I hold this chart of characteristics in my hand, and without pencil and paper am at any moment able to tell the performance of the batteries and thus guage the power that is being expended in running the car.

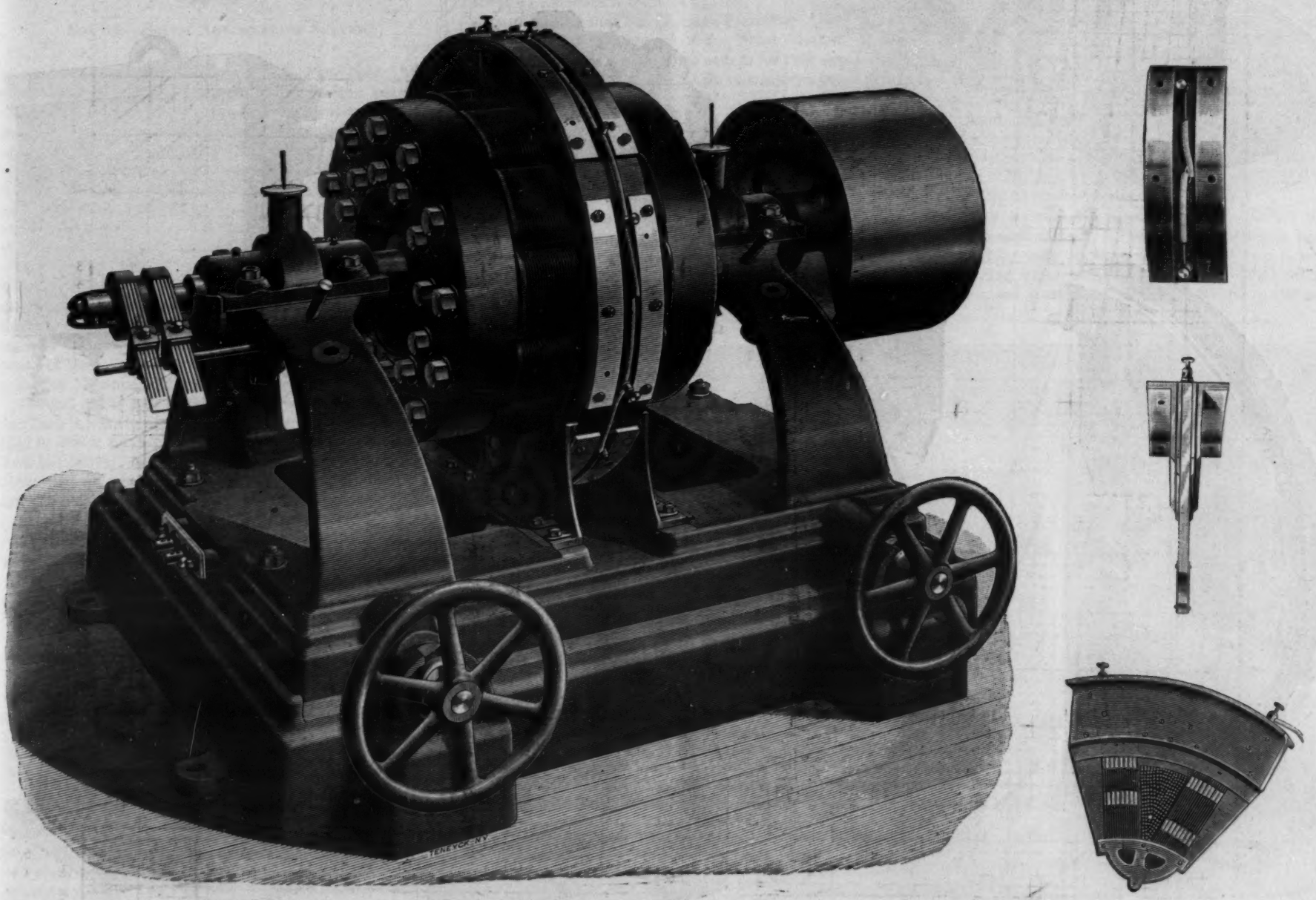
To meet individual or special cases, the scale to which the volts and ampères is drawn can, of course, be indefinitely magnified to insure greater clearness and accuracy.

These are promiscuous and random examples, such as fall within the experience of the electrical engineer, and aside from illustrating what may be called the curious cases which come within his notice or excite the uninitiated, will call forth suggestions from his experience as to their wider application and usefulness.

It so happens that the quantities concerned in the formula for the electrical horse-power make its computation simple and brief. A mental calculation is often sufficient for the purpose in hand, but the writer, with a desire to assist the ignorant or those that "know not how," and at the same time to offer to all whom they more directly concern an abbreviation or simplication of what is but in itself a simple process, presents the accompanying horse-power characteristics in the hope that they may be of as much use to others as they are of convenience to himself.

The Brush Electric Company's New Alternating Current System.

In order to satisfy all the demands which might be made upon it for apparatus for the distribution of electricity, the Brush Electric Company of Cleveland, O., some time ago decided on the elaboration of an alternating current system. For this purpose Mr. C. F. Brush associated with him Mr. Gustave Pfannkuche, and the results of their work are now exhibited in the complete alternating system which the Brush Company is about to introduce. The most characteristic part of the system is the alternating generator shown in perspective in Fig. 1. In this machine the armature is stationary and contains no magnetic material whatever, and it is so constructed that an armature coil may be cut out, removed and replaced without stopping the machine. The field magnets revolve and are carried by the shaft.



FIGS. 1 3, 4 AND 5.—THE BRUSH ALTERNATING CURRENT SYSTEM—GENERATOR.

The machine illustrated has an output of sixty thousand watts; it supplies current for one thousand 16 c. p. lamps.

As will be seen, the shaft bearings, bearing standards, base plate and armature slides are cast in one solid piece and are of ample strength. The centre line of the shaft is 16$\frac{11}{16}$ inches above the surface of the base plate, high enough for access to all parts of the dynamo and low enough for steadiness and freedom from strain on foundations. The 4-inch steel shaft, tapering to 3$\frac{1}{4}$ inches in the bearings, carries two heavy cast iron yoke pieces, 27 inches in diameter. To each of these are screwed, at equal radial and circumferential distances, the wrought-iron cores of twelve magnets of alternating polarity. The two yoke pieces, with their bolts, washers, etc., weigh

about 950 pounds, the magnet cores 880 pounds, and the magnet wire 400 pounds. Thus the whole rotating mass of cast iron, wrought iron and copper acts as a fly wheel, weighing more than 1,700 pounds, and tending to neutralize any variation in the speed of the prime generator. As the nominal speed of the machine is below eleven hundred revolutions per minute, the structural strength is more than sufficient to meet all stresses caused by centrifugal force. Further than this, the mechanical stress is less when the magnets are excited than when the alternator is running without load, as the lines of magnetic force, between the faces of opposing poles, tend to counteract centrifugal force.

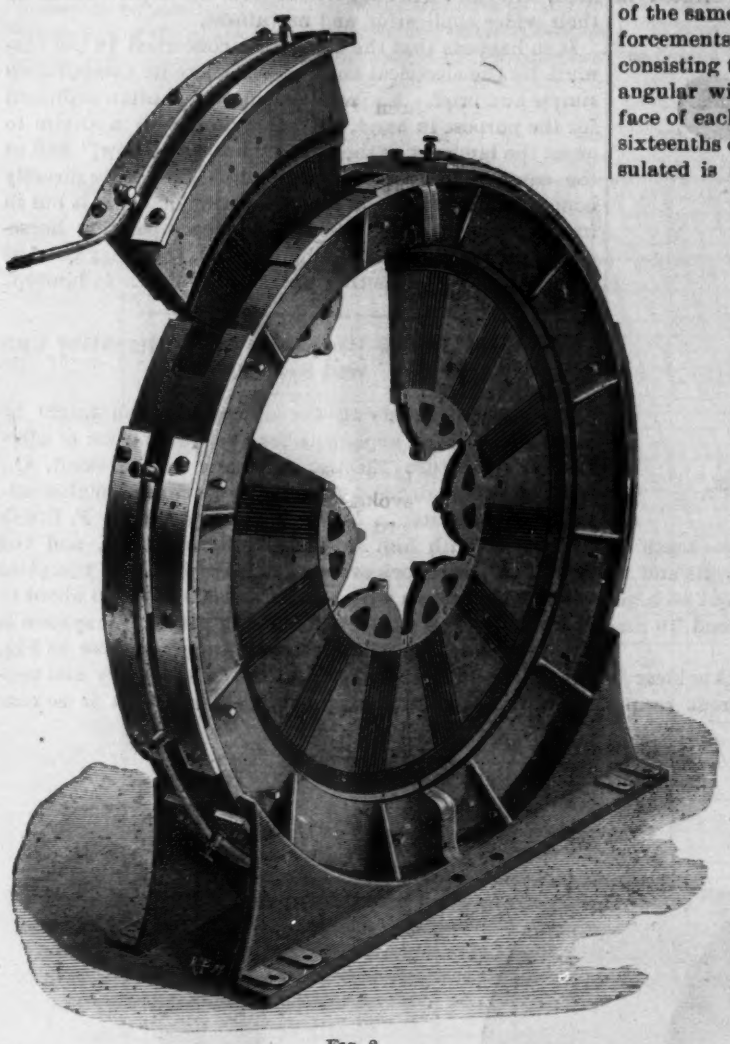


Fig. 2.

In machines of larger size, as usual, the speed is less. that of the 150,000-watt dynamo being not more than 700 revolutions per minute. This larger alternator is driven by two belts and carries a pulley at each end of its shaft. The great advantage of low shaft speed will be appreciated by every mechanic who has a due regard for depreciation of apparatus, cost of oil, attendance, trouble and repairs.

The pulley has a 14-inch face. As it overhangs, the belt may run to countershafting overhead or below. The shaft bearing at the pulley end has 14 inches of wearing surface, and the bearing at the other end 12 inches.

The most interesting part of the alternator is the fixed armature, shown in Fig. 2. The vertical disc is made up of flat armature coils, made of insulated copper ribbon wound on porcelain cores. The copper ribbon of each coil is reinforced on either side with strong insulating material of the same thickness as the porcelain. One of these reinforcements is grooved and the other tongued. The coil, consisting thus of core, ribbon and reinforcements, has an angular width of sixty degrees. The upper part of each face of each coil is covered with an insulating plate five-sixteenths of an inch thick. The coil thus built up and insulated is set in German silver holders, cut from true-turned rings and held together by sunk-headed screws, as shown in Figs. 3, 4 and 5. Each terminal of the copper ribbon connects with a binding post, as shown.

The six armature coils thus mounted are carried in a German silver frame consisting of two semi-circles bolted together on the line of the vertical diameter, as shown in Fig. 6. The cross section of this ring frame is girder-like. The six mounted armature coils slip into the slots of the frame, the tongue on the edge of one engaging with the groove on the edge of the next. The coils thus thrust into the intense magnetic field constitute a disc, nine-sixteenths of an inch in thickness, and with an opening at the centre through which passes the revolving shaft. As there is no magnetic metal in the field, there are no local currents to waste energy, burn out the armatures, and thus interrupt the service.

The several coils are carefully insulated and the stationary armature as a whole is insulated from the bed plate on which it rests. The coils are joined in series, the binding posts adjacent to any radial line of division between two coils constituting fixed terminals for the main line. There is no commutator, and there are no collecting brushes to take the alternating current from rotating parts.

The low resistance of the armature coils is evident from the construction, and none has ever burned out. Should this occur, however, the coil may be removed and a new one readily put in its place in three minutes, or the injured coil may be shunted out of the circuit and the dynamo kept running with the other five until time arrives for shutting down. The coil section complete weighs only about 20 pounds.

The whole armature may be removed by loosening the coupling bolts and sliding each half of the frame with its three coils from between the field magnets, as shown in Fig. 6. As each half, with its coils, weighs only about a hundred pounds, no cranes or blocks are required, and in a few minutes the armature may be back in position. There is, therefore, no necessity to keep extra armatures on hand, a spare section or two being all that is required.

In action, the twenty-four field magnets of the alternator are excited by the direct current from an 11-inch Brush dynamo of the well-known form. This exciting current is carried to the brushes that rest upon the two uncut insulated rings, shown at the left in Fig. 1, and thence through the hollow shaft to the magnets. A rheo-

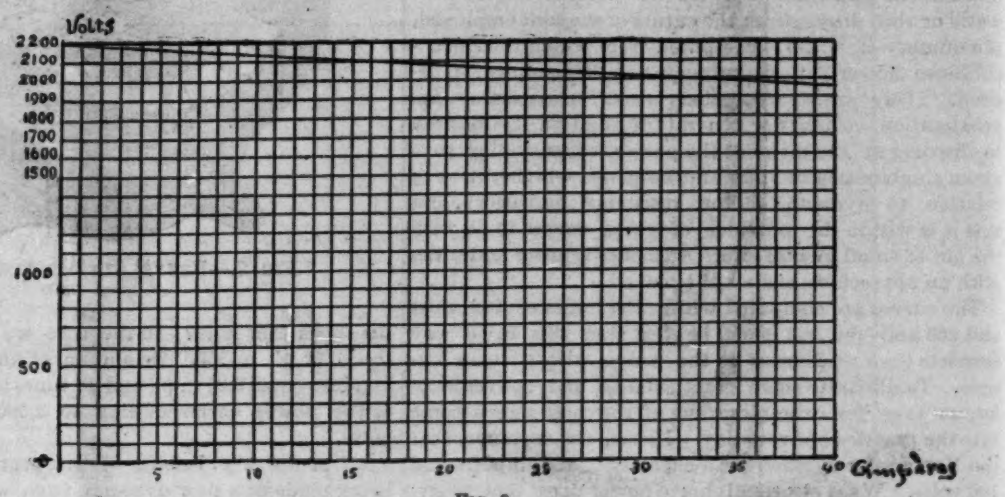


Fig. 8.

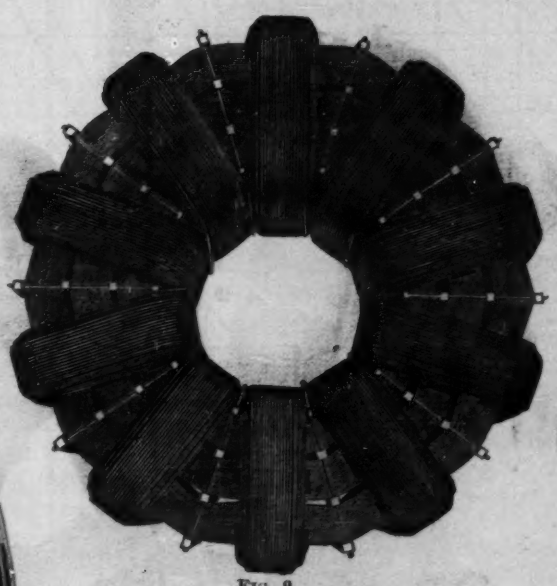


Fig. 9.

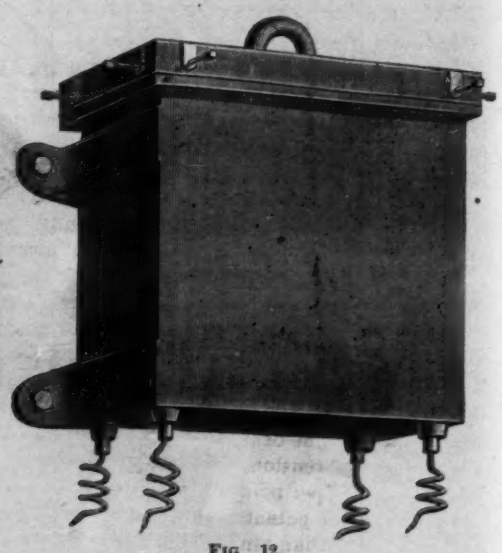


Fig. 12.

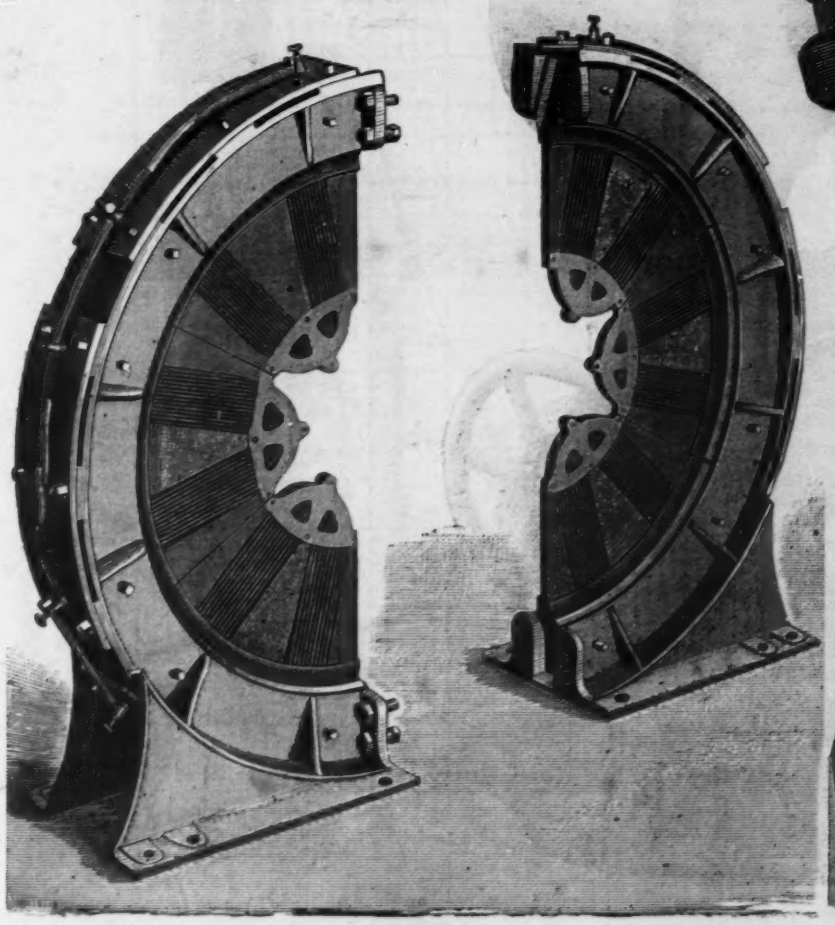


Fig. 6.

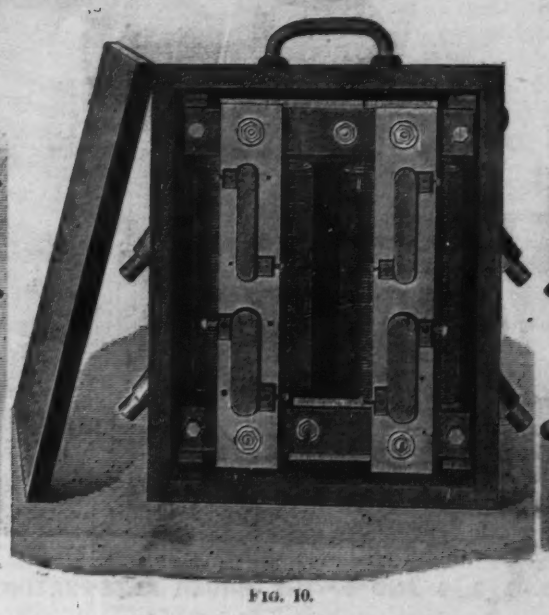


Fig. 10.

Fig. 11.

FIGS. 2, 6, 8, 9 10¹ 11 AND 12.—BRUSH ALTERNATING CURRENT APPARATUS, ETC.

stat, Fig. 7, worked by hand or automatically, is placed in the shunt circuit around the field magnets of the exciter, so that perfect regulation is secured without readjustment of the brushes or any necessity of handling the high tension alternating current.

The desire for a magnetic field of maximum intensity has hitherto led to massive magnets encircling armatures with hundreds of pounds of iron core, upon which was wound a thin layer of conducting wire. But magnetization and demagnetization involve molecular movement

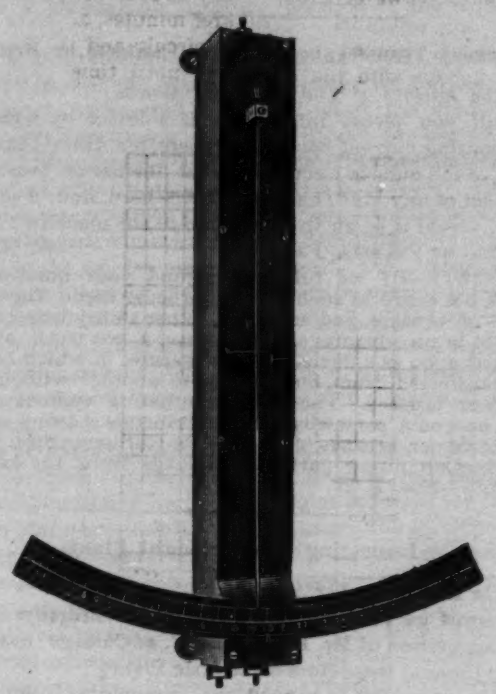


FIG. 13.—BRUSH ALTERNATING SYSTEM.

of some kind and this movement develops heat. With clear recognition of this fact and its economic bearings, the electrical advisers of the Brush Electric Company made no attempt to subdivide and ventilate a magnetic armature core, but condemned it as a useless contrivance for alternating dynamos. Moreover, a revolving armature without an iron core would be structurally weak. This and other considerations led to the fixed armature without any iron projecting into the magnetic field and, as the necessary complement of this, the rotating magnets.

The Brush "Coreless" alternator is built at present for an E. M. F. of 2,000 volts, although it would be easy to develop a much greater difference of potential. It is confidently expected that the necessity of long distance transmission with a line of moderate cost will soon call for currents of higher tension, as economy of power as well as economy of copper point in this direction.

The fall of the potential in the machine from no load to full load is less than ten per cent., as is shown in the curve, Fig. 8, which represents a diagram taken from one of the first machines. All this is accomplished without compound winding or artificial regulation of any kind, a result which, it is claimed, has not been approached by any alternator with an iron core in its armature. All the regulation needed is applied at the exciter as already described. This results in a more even distribution of potential in the feeders and at the converter terminals, and a more even pressure at the terminals of the lamps beyond.

In the Brush Company's new converter, shown in Fig. 9, the core consists of a polygonal ring made of insulated iron wire of the best quality, so wound as to leave several concentric air spaces in the core. In the converters of the smaller sizes the core is built up of thin perforated iron plates, and constructed as shown in Fig. 10. In both cases the iron is so divided that the efficiency of the converter is little less with half load than with full load.

Upon each side of this core or iron ring is wound a single layer of heavy copper wire. The four or five single layers of coils carried by each half of the core are joined in series, and the two groups, borne by the two halves of the core, are joined in multiple, the whole constituting the secondary coil. The terminals of this secondary coil connect with the secondary main line running into houses and supplying current for the lamps. Most of the converters are wound so as to give a secondary current of about 100 volts, but may instantly be connected to give 50 volts and twice as many ampères as before. They are made in sizes that supply each from 5 to 250 16 c. p. lamps or more.

Between the fine iron wire of the core and the heavy copper wire of the superposed secondary coil, insulating pads, one-eighth of an inch thick, are placed at the corners of the core, Fig. 9. Between these insulating corner pieces are insulating air spaces. Thus the copper and the iron are separated from each other at the corners of the core by their respective coverings and the insulating pads; at all other points by their respective coverings and open air spaces, the latter affording ample ventilation and facility of examination.

Over each of these single layer parts of the secondary coil, a few layers of smaller copper wire are wound to form a corresponding part of the primary coil. These corresponding parts of the secondary and primary coils are separated from each other by insulating pads at the corners and intervening air spaces, in the same manner and with the same object as previously described.

The ventilation of these converters has been specially provided for, and insulation resistance is exceedingly high. It is impossible to so overload the wire of the primary circuit as to force its current into the secondary circuit; so that the high tension current cannot pass the converter. All converters are tested at the factory with double load and not one has ever given out. Nevertheless, overloading is made impossible by the use of safety fuses for the primary coils. These are extra long, and are so mounted on slate or porcelain strips that they may be removed or replaced without touching any metallic part of the converter.

The converter coils, with safety fuses, etc., are placed in wind-proof and weather-proof cast-iron boxes shown in Figs. 11 and 12, and may be placed wherever most convenient.

The Brush Company's converters are now made in eleven sizes, from No. 1, which is capable of feeding 2 lamps, to No. 11, which feeds 250 lamps, the intermediate sizes being for 5, 10, 20, 30, 40, 50, 75, 100 and 150 lamps.

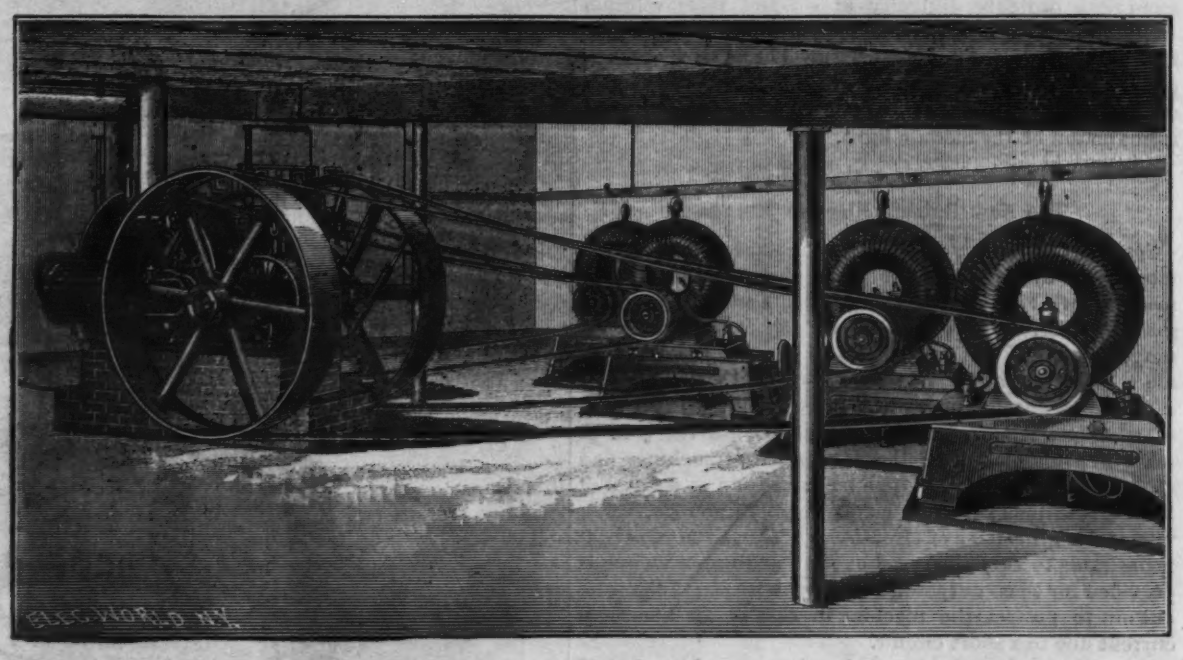
With converters as with dynamos, the larger sizes are the more economical. With a 100-volt converter, fed by a 2,000 volt primary current, it is easier and more profitable to run a short secondary main to supply several consumers than to provide a converter for each consumer.

Fig. 13 represents the ammeter placed in the main or feed circuit, wherever it is desirable to measure the strength of the current. It is a compensated expansion device, acting on the principle of one type of Mr. Brush's arc lamp, constructed in 1879. It is free from any magnetic action, and the simple compensating arrangement insures the normal working of the apparatus at all temperatures. It is equally efficient with direct and with alternating currents.

We understand that Mr. Gustave Pfannkuche will have the supervision of this branch of the Brush Electric Company's business, and that large orders for this apparatus have already been taken, so that its commercial success is fully assured.

The Mather Plant in the New California Theatre, San Francisco.

The opening of the new California Theatre, at San Francisco, on May 13, was an unusually notable event, presenting many features of interest to electricians, as well as to the general public. Aside from the fact that the farewell appearance of Edwin Booth and Lawrence Barrett took place, the theatre attracted attention on account of its being the first on the Coast to be lighted exclusively by electricity, and because it is not excelled, and perhaps not equalled, by any theatre in the United States in magnificence of interior decoration and completeness of appointments.



THE MATHER PLANT IN THE NEW CALIFORNIA THEATRE, SAN FRANCISCO.

The new temple of Thespis is situated on the site of the famous old California Theatre, at the rear of, and entirely isolated from, the California Hotel now being erected—only the vestibule extending through the latter building. It is perfectly fire-proof, and has 19 exits. The main entrance, on Bush street, is formed by a Roman arch of massive proportions and striking design. The vestibule is rectangular in shape, is finished in antique oak panelling, with pilasters and arabesques, and is lighted by thirty-two 16 candle-power lamps and an electrolier of eight 32's. In the beautiful foyer is another large electrolier.

In the auditorium, behind the eight proscenium boxes, with dome-shaped canopies supported by columns, rise arches of Indian fretwork carrying pillars surmounted by 89 candle-power lamps inclosed in opalescent globes shaped like pineapples. The ceiling consists of three concave divisions extending from wall to wall parallel with the front of the stage, gradually rising upward, and separated by narrow panels or chords. It is crossed by four bands of dark color, in which, as well as in the chords and fantastic tracery of the decorations, are set numbers of lamps. From the ceiling, over the parquet and near the boxes, depend three rich electroliers similar in design to those throughout the house, formed by a centre fixture of opalescent glass held in cast metal work, with four pendants of the same shape hanging by chains attached to arms radiating from the stem of the fixture. All the electroliers were specially designed by J. M. Wood, of Chicago, the architect.

Throughout the house the decorations are so designed that lamps in the midst of bands of flowers, dados and carvings, not only afford light, but add hitherto unknown features to the general ornamentation. At the back of the metal and plastic tracery of the boxes, balcony and gallery, panels of cathedral glass are inserted, which soften the radiance of 16 candle-power lamps set behind, and give to the railings the effect of carvings thrown into relief by mellow light.

In the basement of the building, directly under the entrance, is the engine and dynamo room. Four 400-light Mather dynamos, placed diagonally across the room, are driven at 1,100 revolutions per minute by two Payne automatic high-speed engines, supplied with steam by two Abendroth & Root boilers of 120 horse-power each. Two more dynamos and an engine will be added on the completion of the hotel.

Conveniently located at the rear of the room is the main switchboard, to which the dynamos are connected by lead covered cables laid under the floor. A very complete set of appliances for handling the heavy currents is attached to this switchboard. There is a large double-pole 500-light switch for each machine; two of Professor Anthony's differential voltmeters for obtaining the potential of each machine before it is switched into circuit, together with numerous smaller switches and cut-outs of lesser importance.

From this switch-board feeders run to the stage switch-room, which is a model of convenience and utility. Here are situated all the stage fuse boxes and part of those for the auditorium, with ingenious devices for controlling and regulating the lights, by which any number of novel and beautiful effects can be produced.

The stage circuits are seven in number, having three divisions to each circuit, for red, green and white lights. There are four sets of borders, having 76 16 c. p. lamps each, 38 being white, 19 green and 19 red. The footlights have the same number of lamps arranged in the same manner. For producing winter and moonlight effects, and as a substitute for calcium light, six movable bunch lights, with silvered reflectors, are provided.

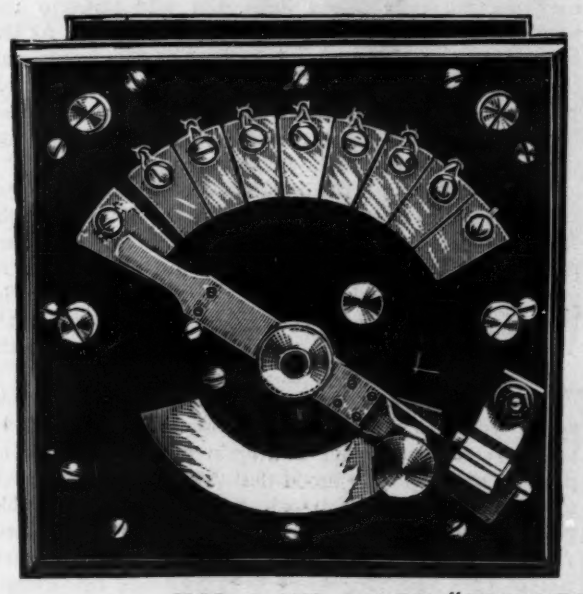
The rheostats, which control all the lamps in the house, are of novel design. They are divided into six parts, which are in connection with six step-by-step switches, capable of being operated rapidly and positively. The handles of the switches can be locked to a shaft which runs through all; by tightening the handles of the switches to the shaft every part of the house can be dimmed at once, and by loosening any number, any portions can be regulated at the will of the switchman. Being equally divided, one-half the lamps in the auditorium can gradually be turned down while the other half is being lighted, producing a fine blending effect. This is probably the only theatre in the country where the switches are so arranged.

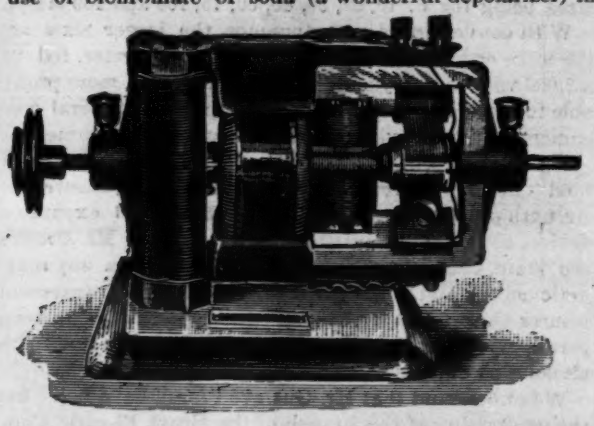
The main feature of the rheostats, made of tubular iron entirely faced with asbestos, is the winding. Twelve wires are in parallel to the first connection from the switch, then eleven to the next, etc., decreasing to a single wire;

when this point is reached, the current is absorbed and the lights are entirely extinguished.

All wiring is done in duplicate, so that the lamps are on alternate circuits; that is, there are two circuits for each row of lamps, which are connected first to one and then to another. By this arrangement, with the double fuse boxes used, no portion of the house would be in darkness if the fuse were to burn out. There would be a slight decrease in candle power for a moment, but no dark spaces. The wire is all weatherproof, is run principally in mouldings, and is entirely concealed. The loss from the stage switch-room outward is one per cent. Fixtures are on separate circuits, and keyless sockets are used throughout the house, except in the smoking room, etc.

The building is seventy feet wide, eighty feet high and





FIGS. 1 AND 2.—NEW "DETROIT" ELECTRIC MOTOR AND SWITCH.

125 feet in depth. The stage is forty feet deep, fitted with the most modern appliances, and provided with scenery specially painted. The auditorium is seventy-three feet in depth, with a seating capacity of 1,750, and the rows of seats have more than the usual amount of space between them.

The installation has been done by the Chicago office of the Mather Electric Company, J. H. Reed, agent, under the immediate supervision of W. M. Thomas, E. E., and B. M. Kellogg, of Chicago—most of the apparatus for regulating the lights having been designed and constructed by Mr. Thomas. In the lighting of this theatre questions of more than ordinary difficulty arose, and their solution certainly reflects great credit upon the parties concerned in the installation of the plant. The success of the enterprise will, doubtless, exert much influence towards the complete abandonment of gas for such purposes, and the introduction of the electric light.

The New Detroit Electric Motors.

Some time since we described in these columns the small motor built by the Detroit Motor Company. This type of machine, which is illustrated in the accompanying engraving, Fig. 2, is characterized by the peculiar arrangement of the field magnets, of which there are two, situated one on either side of the shaft and connected by a common pole-piece. This type of machine, however, is only employed for the ¼ h. p. machines suitable for driving fans, sewing machines and other light machinery. These machines run at a speed of 2,000 revolutions per minute and weigh 15 pounds, being wound for all classes of circuits. In situations where it is desirable to vary the speed of the machines, a switch is provided for that purpose, together with an automatic cut-out to protect the machine in case of an abnormal current due to a short circuit.

For the larger motors, ranging in power from ¼ to 15 h. p., the design shown in Fig. 3 has been adopted. In these machines the four vertical field magnets are connected to common pole-pieces which encircle the armature.

When connected to incandescent circuits it becomes necessary to guard against an abnormal rush of current in a motor before it has reached its normal speed and generated sufficient counter E. M. F. to oppose the direct E. M. F. For this purpose the Detroit motors have provided a special starting switch, which is shown in Fig. 1, by which the current is gradually increased and passed to the motor on starting.

In addition to this, the switch is so arranged that in the case of a shut-down at the central station the lever will fly back and leave the circuit broken. This saves the fusing of the plugs and possibly a burned out armature, when the current is started again.

In stopping the motor, it is usually necessary to operate two switches, one breaking the main circuit, the other the armature circuit. Sometimes by carelessness, the armature switch is not turned back, and when the main switch is closed, the armature is very often burned out. This trouble is entirely obviated by the starting switch, for, when the main circuit is broken, the armature switch simply flies back to its original position and the switch is ready to be thrown on again. Both switches, the main and the armature, are included in one, and are operated by one movement.

The speed of these machines varies from 2,400 revolutions per minute in the ¼ h. p. motor to 1,300 revolutions in the 10 h. p., the former weighing 72 pounds and the latter 945 pounds.

The Jarriant Battery Patent.

To the Editors of The Electrical World:

The important decision just rendered here in an interesting patent suit, which declares the Jarriant patent No. 1,956 of 1882 invalid in England by reason of the prior patent No. 1,643 of 1871 issued to Henry Highton, both covering the use of bichromate of soda in primary batteries, illustrates the careless and slovenly manner in which the patent examiners in the United States Patent Office do, or neglect to do, their work.

In October, 1885, two patents, Nos. 328,687 and 328,948 were granted to Theo. C. Kauffer, covering broadly the use of bichromate of soda (a wonderful depolarizer) in galvanic batteries. Relying on the *prima facie* evidence of the originality of the claims as passed by the Patent Office examiners, a strong company called the Chemical Electric Light and Power Company was formed which bought the patents. After spending several thousand dollars, perfecting devices to operate the invention or discovery, it was discovered that a Frenchman named Benoit Jarriant had used bichromate of soda in galvanic batteries, and had taken out a patent thereon, both in France and England, the latter in April, 1882 (Thos. John Handford, No. 1,956, by communication from France).

As Jarriant had the right to apply for and take out

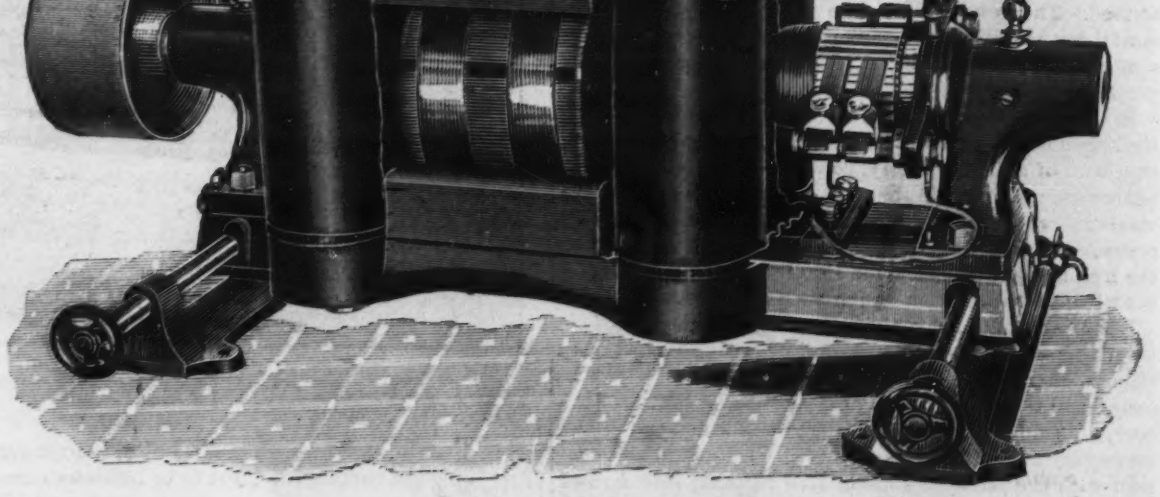


FIG. 3.—NEW "DETROIT" ELECTRIC MOTOR.

patents in the United States, his invention not having been publicly used here for two years, Jarriant's rights (?) were purchased, on the advice of an expert examiner, and his application filed here. He was put in interference with Kauffer, and to save time and expense to the company Kauffer conceded priority to him, and patent number 2, covering bichromate of soda in batteries, was granted Sept. 21, 1886, No. 349,222, and assigned to the aforesaid company. Again, relying on the examiners, who must have felt some chagrin at their former oversight, more money was expended, licenses were issued, territory and royalty stamps were sold and much business was done, until suddenly news came from London that another English patent covering the use of bichromate of soda had been found on file in the British Patent Office dating as early as 1871; so early, indeed, that the fourteen years of its term had expired, making the use of bichromate of soda in batteries public property in England, in the United States and in all countries.

The Superior Court here has now decided that the Jarriant-Handford patent was *invalid*, by reason of prior publication in the Highton patent of 1871, and, consequently, the Chemical Electric Light and Power Company could not recover, and had no valid patent anywhere. But how about the U. S. Patent Examiners? DECEIVED.

BOSTON, Mass.

Current Transference Without Contacts or Brushes.

To the Editors of The Electrical World:

Will you please inform me if a device by which an alternating current could be transferred from the armature to the outside circuit, without the use of brushes or contact of any kind, has ever been used, and, if practicable, would it be an improvement to the machine?

KING OF PRUSSIA, Pa. W. H. R.

ANSWER.—If we fully understand your question, we have not heard of such a *machine* being used. The avoidance of brushes and contacts, other things being equal, might be an advantage. Of course, a converter may be looked upon as a device of this nature, in which current is transferred from one circuit to another without contacts or brushes. The Tesla alternating current motor also acts on a somewhat similar principle, having neither contacts nor brushes connected to the armature, which receives no direct current whatever from the external circuit.—EDS. E. W.

Inspecting Electric Light Plants.

To the Editors of The Electrical World:

Permit me through your columns to heartily indorse the suggestion of Mr. Fred De Land, of Chicago, in regard to "General Inspectors of Electric Plants."

The suggestion is a good one, coming as it does from a gentleman well known in the electrical world (and also THE ELECTRICAL WORLD), who has had most excellent opportunities to observe the working of electrical plants in all parts of the country and who speaks feelingly on the subject.

It is only too true that there are many plants in the hands of men who do not know a dynamo from a load of hay, and whose knowledge is limited to opening the throttle and putting on the grease. We sometimes hear such remarks as "I don't think they use volts now" coming from men who presumably know better.

To such as these the visit of the inspector would be most important.

One or two parent companies have inspectors, but most of them do not. Such a person should be clothed with authority and should know his business, and his word should be law. H. F. WATTS.

ALTOONA, Pa., June 10, 1889.

Charging Storage Batteries from Gravity Cells.

To the Editors of The Electrical World:

I have an accumulator, type 15, and would like to know if I can charge it with 4 cells of gravity battery. Also what are the objections of this method, if any. I use about 10 ampère hours per day, using it 2 hours at 5 ampères per hour. A. B. R.

NEWARK, N. J.

ANSWER.—There is no objection to this method if no other charging source is available. All that is necessary is to have the battery sufficiently long on charge in circuit with the gravity battery.—EDS. E. W.

Automatic Photography at the Paris Exposition.

Probably the farthest extent to which the idea of the "drop-a-nickel-in-the slot" apparatus has been developed is embodied in an apparatus now on exhibition at Paris, in which a person's photograph is taken automatically upon the insertion of the requisite coin in the slot. The apparatus, which is shown complete in the accompanying engraving, Fig. 1, taken from *La Nature*, is due to the ingenuity of M. Enjalbert. It is so constructed as to execute all the photographic processes necessary in order to obtain a photograph upon the insertion of the required coin.

Fig. 2 illustrates in detail the exterior of the apparatus. Here we have at the right the announcement of the coin necessary to be inserted in order to start the apparatus. At the left a spot upon which to fix the eye during the pose. Above this is a series of dials divided into sections over which pass pointers which indicate, at every instant, the operation going on in the interior. A few moments before the pose commences, the needle of the second dial points to the words "prepare yourself," then "attention," and, when it arrives at the black sector bearing the word "pose," the latter commences and a bell, placed above the dials, starts ringing and continues so during the entire pose, which usually lasts from three to six seconds. After the lapse of some time, in all about five minutes, the portrait comes out at the side, finished.

The photographic process employed in this apparatus is what is known as the ferro-type process and needs no further description here, consisting as it does of the preparation of the sensitive film, the exposure, the development, the drying and varnishing, etc. All this is accomplished automatically by means of the apparatus which is shown uncovered in the engraving Fig. 3. The whole mechanism is operated by electricity through the medium of storage batteries and electric motors as well as the action of electro-magnets which are temporarily energized at the proper time.

The operations to which the plate is subjected are performed in four compartments or cases, and shown at 1, 2, 3 and 4, in Fig. 3. The first operation, that of covering the plate with a film of collodion, is performed in compartment 1, *B* showing the position of the plate at the moment at which the plate is being sprayed with collodion. After this operation it is seized by the carrier actuated by the lever *A*, which passes it to the compartment 2. The plate is then plunged into a bath of nitrate of silver *D*, and remains there about one minute, during which it is stirred about several times. The plate is then put into the position *C* for exposure. The length of time for exposure can be regulated in advance according to the condition of the light; this being accomplished by means of a slide which regulates the length of the electric contact by which the shutter is held in position. After having received the light impression, the plate is again seized and transferred to the compartment 3. Here the plate is developed, washed, fixed and washed again. The turning action of the support carries the plate under the faucet of a vessel from which the developer shoots in the form of a spray and is evenly distributed over the plate. The water for washing shoots from the same faucet, and finally the plate is plunged in the fixing bath *F*, containing a cyanide of potassium solution, and is at last drawn out to receive another and final washing. In the fourth compartment the plate is at first washed with alcohol and then varnished. It rests there for some time in order to dry, which is effected by a tube heated on the interior with a special lamp. The plate is then passed to a tube which leads it out of the apparatus. The electro-magnet *I* controls the various faucets for the development and washing of the plate, and the electro-magnet *K* controls the faucets for the alcohol and the varnish.

The whole apparatus is said to operate with extreme smoothness and seems destined to a wide application.

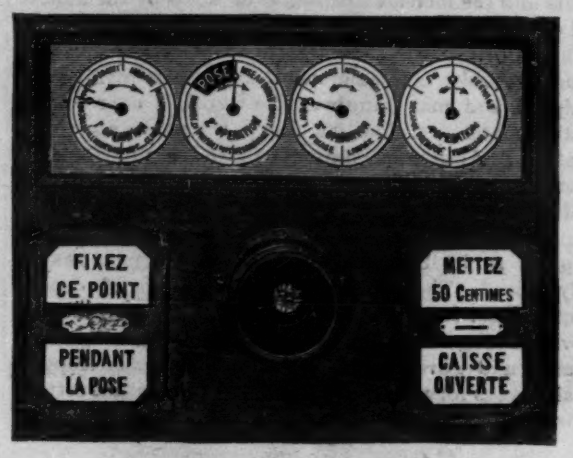


FIG. 2.—ELECTRIC PHOTOGRAPHY, PARIS EXPOSITION.

The "Drop" and Size of Wire in Wiring Calculations.

BY G. T. EVANS.

The articles, with their accompanying formulæ, on house wiring, lately appearing in THE ELECTRICAL WORLD, while, no doubt, supplying the necessary practical information for those who may be confronted with wiring problems, and satisfying the majority of operators who are content with the simple *way* of doing a piece of work, do not, I believe, meet the demands of those whose besetting question is "Why," and who are forever looking for a "Because."

As the "drop" appears to be the main stumbling block for a great many beginners, some having a vague impression that it is a resistance, it may be well at the outset, trite though it may seem, to define what the drop really is.

The drop in volts along a conductor connecting two points is equal to the difference of potential of these points, whatever the resistance of the conductor may be. Hence, if a circuit is composed of wire and lamps, the total drop in volts along the wire and lamps will be equal to the total voltage employed on the circuit; and the drop will be divided between the wire and the lamps in direct proportion to their relative resistances, or, in other words, will be inversely proportional to their conductivities.

For example, let us suppose a circuit carrying a total pressure of 50 volts, composed of a length of wire having a resistance of 50 ohms and a lamp having the same resistance. The drop being proportioned to the resistances, it is evident that in this case it will be equally divided, 25 volts being expended on the wire and 25 volts on the lamp.

In practice the voltage to be used at the lamp, the resistance of the lamp, and the voltage (*i. e.* drop) to be used on the wire are generally known, and the first step is to find the resistance necessary to give the wire to cause the required drop. To illustrate: We have a lamp, resistance 50 ohms, voltage 48, to place in a position 20 feet from the street mains, the drop in volts on the wire to be 2. The pressure on the mains is 50 volts.

It is evident that the resistance of the wire is determined by the following proportion:

$$D_l : D_w :: R_l : R_w;$$

Where D_l is the voltage on the lamp;
D_w, the drop in voltage on the wire;
R_l, the resistance of the lamp; and
R_w, the resistance of the wire.

Substituting the figures given in the example in the above proportion, we get:

$$48 : 2 : : 50 : R_w.$$

Therefore $R_w = 2.083$ ohms, which is the resistance of the required wire.

The resistance of the wire being known, we have now to find what size of wire, having the required length, will have this resistance. From a wire table we find that a foot of commercial copper wire 10.3 circular mils (approximate) in area has a resistance of 1 ohm. Multiplying this number by the number of feet in the circuit, in this case 40, we learn that a wire 412 circular mils in area and forty feet long, has the same resistance, viz., 1 ohm. And since the resistance of the required wire is 2.083 ohms, its area in circular mils must be the area in circular mils of the 1 ohm resistance wire divided by 2.083, which is equal to 197.76 circular mils. This corresponds very nearly to a wire No. 27 B. & S. gauge. Of course such a fine wire would not be used in practice, for obvious reasons, but the principle remains the same.

Finally, problems of this class may be reduced to the formula:

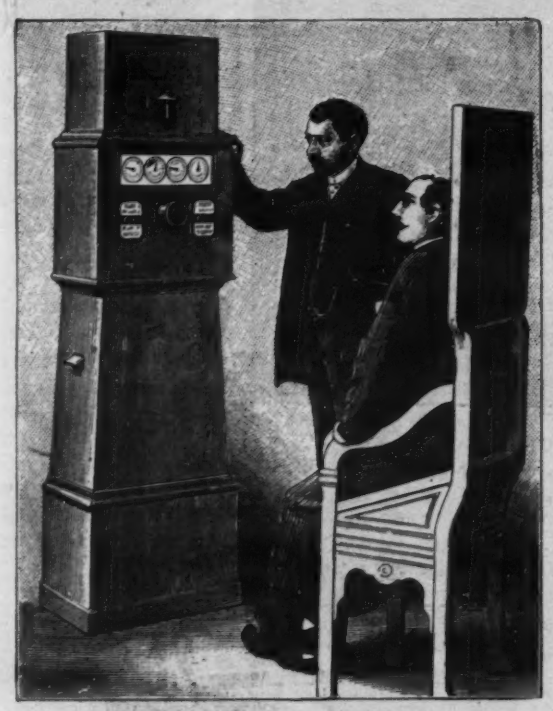
$$\frac{10.3 \times l \times n \times v}{R \times D} = \text{circ. mils.}$$

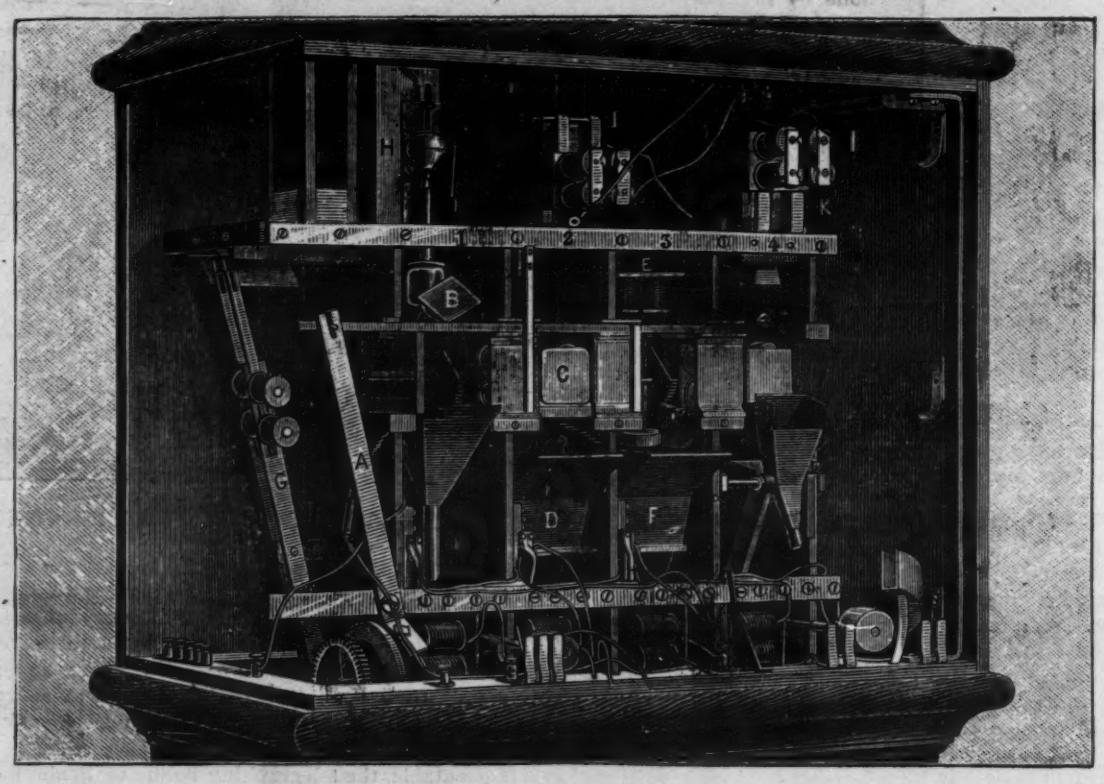
Here, 10.3 = area in c. m. of one foot of copper wire having a resistance of one ohm; l = total length of wire; n = number of lamps; v = voltage of lamp; R = average resistance of lamp; and D = drop in volts on wire.

It is, of course, understood that this article applies directly to the two-wire system only, but formulæ and constants for other systems can easily be deduced from what has been said.

Electric Power and Storage Interests in England.

A few weeks ago our London correspondent announced a consolidation of electric power and storage interests in England. We are now indebted to Mr. Wm. Bracken, President of the Julien Company, for the following details: "Joseph Smith, Esq., director of the Julien Electric Traction Company, Limited, of England has just effected an amalgamation of all the storage battery companies, and the chief electric railway companies of England, under the name of The Electric Construction Corporation, Limited. In this amalgamation are included the following companies: The Julien Electric Company, Limited, of England; The Electric Power Storage Company, Limited, owning the Faure-Sellon-Volckmar patents as well as being the parent company and licensor of the Electrical Accumulator Company of New York; the Elwell-Parker Company, Limited, being a storage battery company of England, and the rival for years of the Electric Power Storage Company, Limited; the Railway Electrical Contractors, Limited; the Sprague patents for electric traction and transmission of power. The capital stock of this new company consists of £500,000. Subscriptions were opened on the 4th of June at par, and were closed the same day for double the amount required. Among the directors are such distinguished men as Sir John Pender, Sir Daniel Cooper, Sir Robert Fowler, Sir Douglas Fox, Sir Henry C. Mance and the like; while Sir William Thomson is consulting engineer of the company."





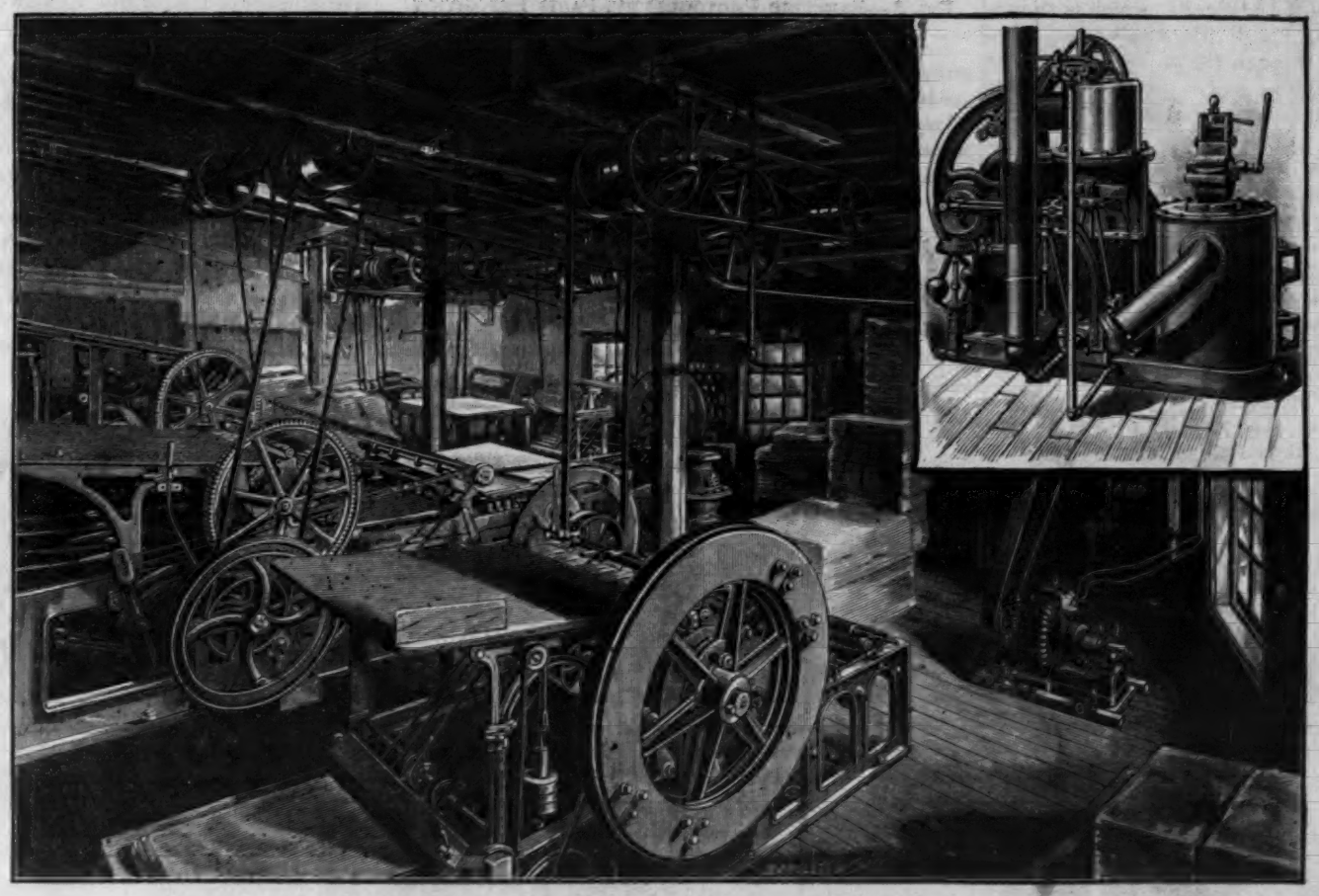
FIGS. 1 AND 3.—AUTOMATIC ELECTRIC PHOTOGRAPHIC APPARATUS, PARIS EXPOSITION.

The C. & C. Motor in Printing Offices.

An interesting pamphlet has just been issued by the C. & C. Electric Motor Company, of this city, relative to their new motors and the work that is being done by them. It is an admirable publication, and the supplemetary data, directions, etc., constitute it a practical hand-book of electric power. As an example of what is being done in New York with electric motors, we show on this page the press-room of Crichton & Co., where a 5 h. p. constant potential motor has been installed and is in successful operation. A noticeable point is that the mo for displaced the hot-air engine, of which a vignette is given in the upper right-hand corner of the cut.

The press-room is equipped with the following presses, all dependent upon the compact little 5 h. p. motor for their motive power: One double super-royal Campbell; one double super-royal cylinder Hoe; one super-royal Campbell country press; one super-royal Campbell medium; one super-royal Campbell pony; one-quarter Gordon job; two one-eighth Gordon job; one 28-inch paper cutter, and one Rumsey pump, 2½ by 8, lifting water 40 feet.

A still more striking example of press-room operation may be mentioned. A few weeks ago the walls of the press-room of the Washington, D. C., *Star* fell in, disabling the engine, shafting, etc., and threatening a prolonged stoppage. The only possible way out of the trouble quickly was to get an electric motor and derive current from the local United States (Edison) plant. This course was followed, C. & C. motors were ordered on by telegram from New York, connections were made, and, thanks to the energy and capacity of Messrs. C. S. Pardoe and P. B. Saunders, of the United States Electric Light Company, and Mr. C. W. Messner, the Washington agent of the C. & C. Motor Company, the *Star* was able to salute its thousands of readers as usual. A full account of the episode is given in the *Star* of June 29, printed by electricity. The paper states that the 15 h. p. motor already put in, two more having yet to be installed, has more than met expectations, and it pays a high compliment to the gentlemen above named for their help in enabling it so courageously to meet the emergency.



C. & C. MOTOR OPERATING A NEW YORK PRINTING OFFICE.

The Government Telegraphs of Spain.

BY HERBERT L. WEBB.

The Spanish government control the telegraph system of the country, as in fact they control, more or less directly, every other public institution, with disastrous results both to the public and to the servants of the public. The government of Spain, whichever party may be in power, is essentially a government of repression, and in no case is this policy more apparent than with regard to the telegraph.

It is little to say that the telegraph service in Spain is a disgrace to a nation that has any pretensions to civilization; no one can have any idea of how bad it is unless they have lived in the country. It is a comparative rarity to receive a quickly transmitted and accurate message even between two points within Spain itself, and when the telegram is couched in the Spanish language. But woe betide the business man who has to send and receive foreign telegrams through a Spanish office. Mistakes and vexatious delays are innumerable, and as often as not the message is utterly incomprehensible and valueless.

Often it is impossible to send or receive a telegram for a considerable interval of time, owing to the irregularity with which the service is performed. Let a shower or two fall and the lines work badly; if the rain continues for any time, communication is interrupted altogether, and often for days at a time. On the occasion of a not very severe storm I have seen Madrid telegraphically cut off from the provinces on all sides, north, east, south and west; and during the winter and spring it is no uncommon occurrence for important towns on the coast to be without communication with the interior for days and days at a time.

The cause of all this lies with the parsimonious and niggardly economy of the government. Everything is cut down to the finest possible point. The offices are poorly manned and the personnel is badly paid throughout all its ranks. The lines are badly constructed, for want of good material and skilled labor, and their supervision and maintenance are miserably inefficient. The instruments are mainly of the most antiquated type and of the cheapest make obtainable. With the exception of a few Hughes' printers in use on some of the more important lines, there is not a modern telegraph instrument in the country, and in all Spain there is not a single duplexed line doing regular work, although some experiments have been made with a duplex system invented by a Spanish telegraphist. The enormous advances that have been made in telegraphy with the introduction of fast speed automatic instruments and the increased capacity of wires by the duplex and quadruplex systems, do not exist for Spain.

The unfortunate Spanish telegraph department, besides being probably the worst paid and most inefficiently equipped and maintained in the world, is oppressed in another manner, prejudicial both to the public and to the employés. Almost every official in the multifarious departments of the Spanish government, down to those holding the most unimportant positions throughout the country, has the right to free communication by telegraph on public business, and this right is most shamefully abused. The ministers and other heads of departments almost daily send by telegraph to all parts of the provinces long-winded circulars which might well be sent by mail, and governors of provinces and understrappers of all grades forward comparatively unimportant returns to headquarters by the same means.

These official telegrams take precedence over all others, and as they are always couched in most flowery language, without the slightest attempt at abbreviation, often containing several hundred words apiece, the delay and inconvenience to the public are immense, and a large amount of unnecessary and unremunerative work is thrown upon the hardly-used telegraph department. If, as is indisputable, the telegraphing public of Spain have just cause for complaint in the extremely unreliable and inaccurate service which they have to put up with, it is also true that that service is performed by a body of public servants who are underpaid and overworked, and who labor under greater disadvantages as to promotion and proper recognition of their efforts than those of any other telegraph administration in the world.

The amount set apart for the telegraphs in the Spanish budget of the present year is $1,471,541.50, of which sum $992,574.50 goes for salaries, and the remaining $478,967 for maintenance of lines and offices and for special expenses. The highest officer in the service receives a salary of only $2,000 a year; the heads of districts in the provinces are paid salaries varying from $600 to $1,300, while a superintendent of a station draws but $500 a year. There are four different classes of operators, the highest of which have $400, and the lowest $200 a year. Besides these there are temporary operators, who are liable to be discharged at any moment, and are at rates varying from thirty to fifty cents per day. It is obvious that a service so poorly remunerated as this cannot be efficient, especially when in addition to being badly paid the personnel is numerically weak. In Spain, including the Balearic and Canary Islands, there are some 570 telegraph offices. To work these are employed 390 higher officials, directors, sub-directors and superintendents, and 1,138 operators of all grades, exclusive of *temporeros*. That is to say, that for a a country with a population of 17,000,000, there are about half as many qualified telegraph operators as may be seen daily at the London central office!

In many small towns and villages the telegraph operators have to perform the duties of postmasters as well as their own, and for this they get no extra pay. Both the political and technical press of Spain constantly comment upon the grievances of this much-abused body of public servants, but, as the telegraphists have little or no political influence, redress is difficult to obtain.

Last year Spain raised the rank of several of her representatives at foreign courts from that of minister to that of ambassador, with corresponding increase of pay; this year she takes off more than fifty thousand dollars from the salaries of her already underpaid telegraph employés. Comment is superfluous. From our youth up we have been taught that "comparisons are odious," but it is instructive to confront the working of the telegraph in Spain with that of a few other continental countries, putting Great Britain and the United States aside as leading the universe in the adoption and development of that all-powerful agent of civilization.

Spain has a population of about 17,000,000 and she possesses about 11,000 miles of telegraph line, 27,000 miles of wire, and sends about 3,000,000 paid messages per year. France has but two and a half times the population of Spain, yet she owns nearly five times the mileage of line, six times the mileage of wire, and sends nine times as many telegrams. Austria has twice Spain's population, three times as much line, three and one-half times as much wire and sends three and one third times as many messages. Belgium, with a population less than a third of that of Spain, has three-fifths as much mileage of wire and sends more than twice as many messages. Denmark, Holland and Roumania compare in all respects in a manner equally unfavorable to Spain, and even Portugal has considerably more wire and sends about one-third more messages per year in proportion to her population. Italy is the only other European country whose telegraph statistics stand upon such a low footing as those of Spain, while the most startling comparison is obtained with Switzerland. That republic has less than one-sixth the population of Spain, yet she has more than two-fifths the mileage of wire, and sends almost exactly as many messages per year as Spain does.

Ferro-Manganese Alloys.*

BY B. H. BLOOD.

The object of this thesis was the investigation of Mr. Edward Weston's claims for alloys of copper and ferro-manganese giving negative or zero temperature co-efficients. Owing to the extremely high fusing point of ferro-manganese, the arc proved to be the only available means of fusing the metals into an alloy. Specimens were obtained, rolled out, cut into narrow strips of about one ohm resistance each, and their resistance measured by fall of potential. Each piece was measured through a range of from 80 degrees to 100 degrees C. in an oil bath. The results obtained may be briefly summarized as follows: Adding ferro-manganese to copper rapidly increases its specific resistance, and decreases its temperature co-efficient, until it approaches zero, when further additions produce little change in coefficient. By the addition of about 5 per cent. of nickel, small negative coefficients were obtained. The coefficient depends very largely upon physical conditions, specimens which gave positive coefficients when either hard-rolled or thoroughly annealed, giving small negative coefficients when partially annealed. Annealing invariably reduces the specific resistance, usually from 5 to 8 per cent., showing the alloys to be poorly adapted for use as standard coils unless very thoroughly annealed.

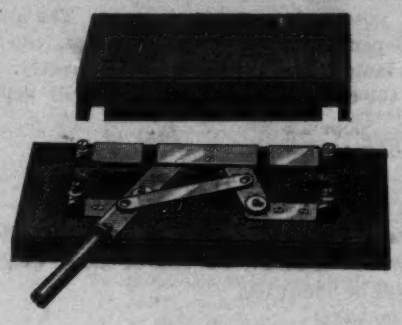
* Abstract of Thesis.—Cornell *Crank*.

Alloys with 10 per cent. ferro-manganese gave a specific resistance of 12, with temperature coefficient of 1 per cent. in 100 degrees. With 20 per cent. ferro, the sp. res. is about 30, with a coefficient of from one-quarter per cent., negative, to one-half per cent., positive. With 30 per cent. the sp. res. is 45, with no further change in the coefficient. With the addition of nickel, the coefficient dropped to one-half per cent. negative at the lowest.

Hence with about 6 per cent. of ferro-manganese, we have about the same results as German silver gives, and with more ferro-manganese, the coefficient may be reduced, but at the expense of conductivity.

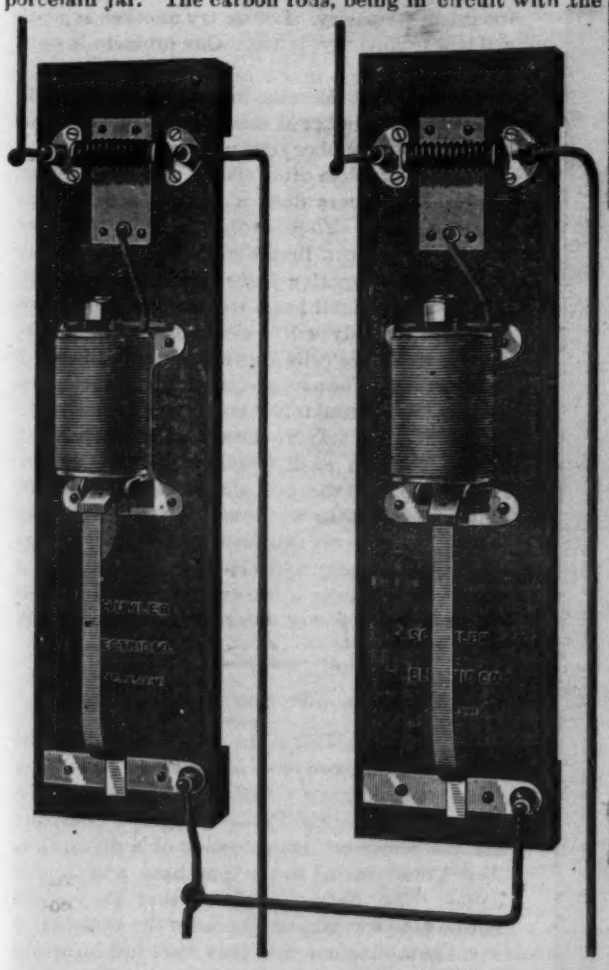
New Apparatus of the Schuyler Electric Company.

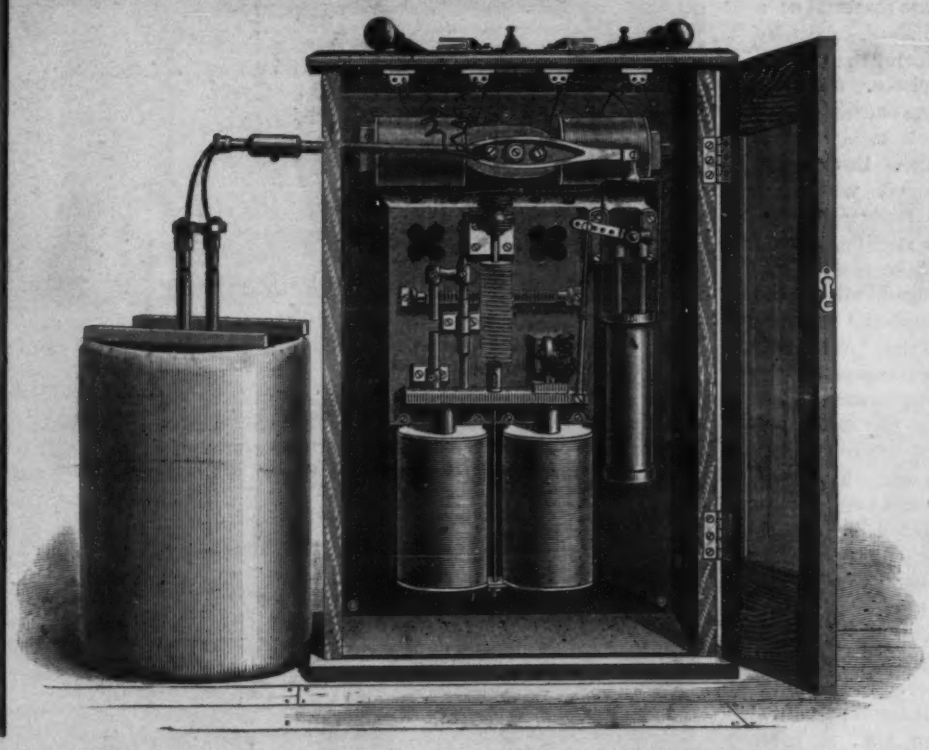
For some time past the Schuyler Electric Company, of Middletown, Conn., have been engaged in improving their well-known apparatus, with the result of increasing its efficiency in various ways. The armature of the Schuyler dynamo, it will be remembered, is of the open-circuit drum type, and special arrangements have been made for ventilation. It is claimed that not a single burn-out has ever occurred with this type of armature.



FIGS. 5, 2 AND 6.—DETAILS OF THE SCHUYLER ELECTRIC LIGHTING SYSTEM.

The regulator by which the current is kept constant under all conditions has also been improved, and now presents the appearance shown in Fig. 1. The regulator, as will be seen, contains mechanism which acts to vary the position of a horizontal rod extending out at the side of the case. This horizontal rod carries two carbon rods which dip into a conducting liquid contained in a white porcelain jar. The carbon rods, being in circuit with the field magnets, it follows that their position with respect to the liquid directly influences the strength of the field magnets by introducing into, or withdrawing resistance from, the field circuit. In this manner the strength of the field magnets is varied so that the current remains constant, no matter what the number of lights in circuit.





FIGS. 3, 1 AND 4.—DETAILS OF THE SCHUYLER ELECTRIC LIGHTING SYSTEM.

Among the other station apparatus recently improved we note the ammeter and lightning arrester shown in Figs. 2 and 3. The latter is automatic in its action, and breaks the circuit so as to prevent a short circuit following a lightning stroke, but automatically restoring the circuit to its original condition of continuity.

The illustration, Fig. 4 shows the Schuyler series lamp which is placed directly in the arc circuit and is intended for illuminating large interior spaces, stores, etc. Figs. 5 and 6 show respectively a new hanger board and a cut-out. The latter consists of a double pole switch which makes an instantaneous break, and disconnects entirely a branch circuit from the main line.

Recent Actions at the Patent Office.

BY WM. A. ROSENBAUM.

Inventors and practitioners before the Patent Office will no doubt welcome the recent action of Commissioner of Patents Mitchell regarding the temporary withdrawal of the drawings from the files of the office. Formerly, persons in the attorneys' room and the office examiners had the privilege of withdrawing from the files copies of the patent drawings for inspection, and holding them several days. This practice rendered it almost impossible to determine the correct state of the art, and attorneys were sometimes put to a great deal of unnecessary work by reason of it. It had the effect, at least, of throwing doubt upon the result of searches made at the Patent Office. The following is a text of the commissioner's order, and as soon as the files have been put into shape in accordance therewith searches may be made with a reasonable degree of accuracy.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.
WASHINGTON, D. C., June 8, 1889.

From and after this date the withdrawal of the photo-lithographs, and in process and composition patents the copies of specifications and claims, from the classified sets in the Draughtsmen's Division, for any purpose whatever, by examiners, attorneys, or others, is prohibited. These classified sets will be retained intact and held accessible to the public from 9 o'clock A. M. to 4 o'clock P. M., daily. Such copies as may be desired for use by examiners will be promptly furnished from the unclassified sets upon application to the Draughtsmen's Division.

The Chief of the Draughtsmen's Division will cause all classes and subclasses embraced in these sets to be made complete, and be put in order and kept so.

(Signed) C. E. MITCHELL, Commissioner.

A decision has recently been rendered by Assistant Commissioner Fisher on a question of considerable importance to attorneys and inventors, which, on account of its not having been published, is no doubt generally unknown. The question was as to whether "process and product" or "method and apparatus" claims might be included in a single application, and it was decided by Mr. Fisher that the two species of claims properly belong or may be embraced in the same application. The decision is that of McMahan, MS. Dec. Vol. 40, p. 257. This decision in itself probably will not change the present practice of the office, but it perhaps is an indication of the mind of the commissioner. It at least presents a favorable opportunity for some one to secure a reversal of *ex parte* Herr, the decision on which present practice is based. It is notorious that practice on this question has been changed a number of times, each commissioner usually reversing his predecessor. These changes, however, are likely to occur so long as the office of Commissioner of Patents is subject to change and the commissioner has jurisdiction in such matters.

The Magnetic Influence of Locomotives on Watches.

A committee consisting of Messrs. Gentry, Meehan and Middleton reported to the Master Mechanics' Association on the above subject at the recent convention. The committee had received considerable information by letter and otherwise. The committee is satisfied that irregularities in watches carried by locomotive runners are attributable to rough usage more than to magnetic disturbances, but it is considered that there is sufficient magnetic influence to make it desirable, if possible, to protect watches from it. There is much more danger, however, that the runners' watches are magnetized from exposure to electric plant than from any influences generated on the locomotive. The committee can recommend no system for protection against such influence, but it is convinced that much depends upon the handling of the watch and the care given it by the man in whose charge it is. An inferior timepiece, in the hands of a careful man, is sometimes more reliable than the finest watch in the hands of a runner who has no system in his method of winding, etc.

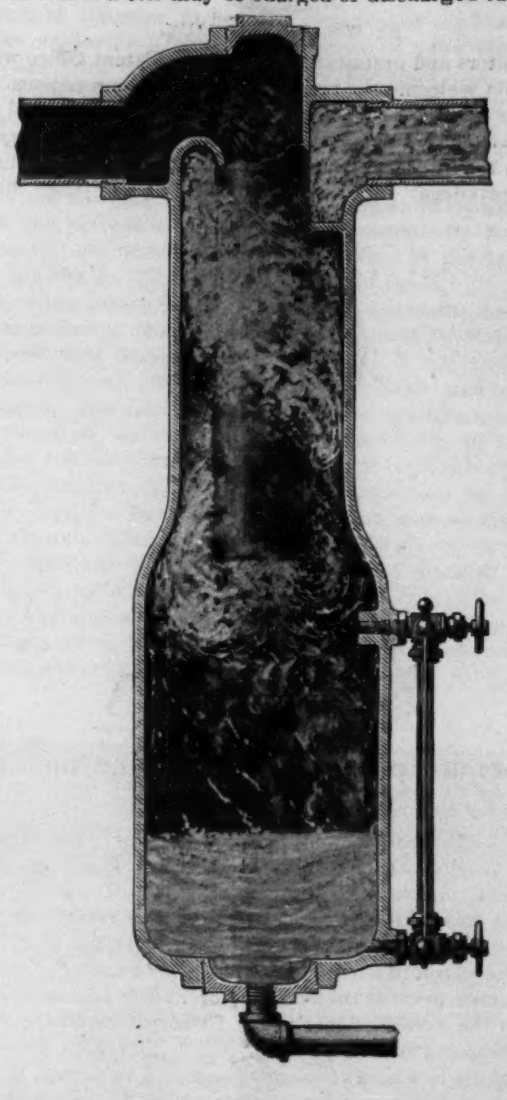
Stimulating the Engine Industry.—Over the American section of the machinery hall at the Paris International Exhibition an inscription has been put up stating that the United States possesses steam engines of 450,000 h. p., the power of which is transformed into electrical energy; that, apart from transmission of power, this energy is used to supply current nightly to 2,000,000 incandescent lamps and 250,000 arc lamps.

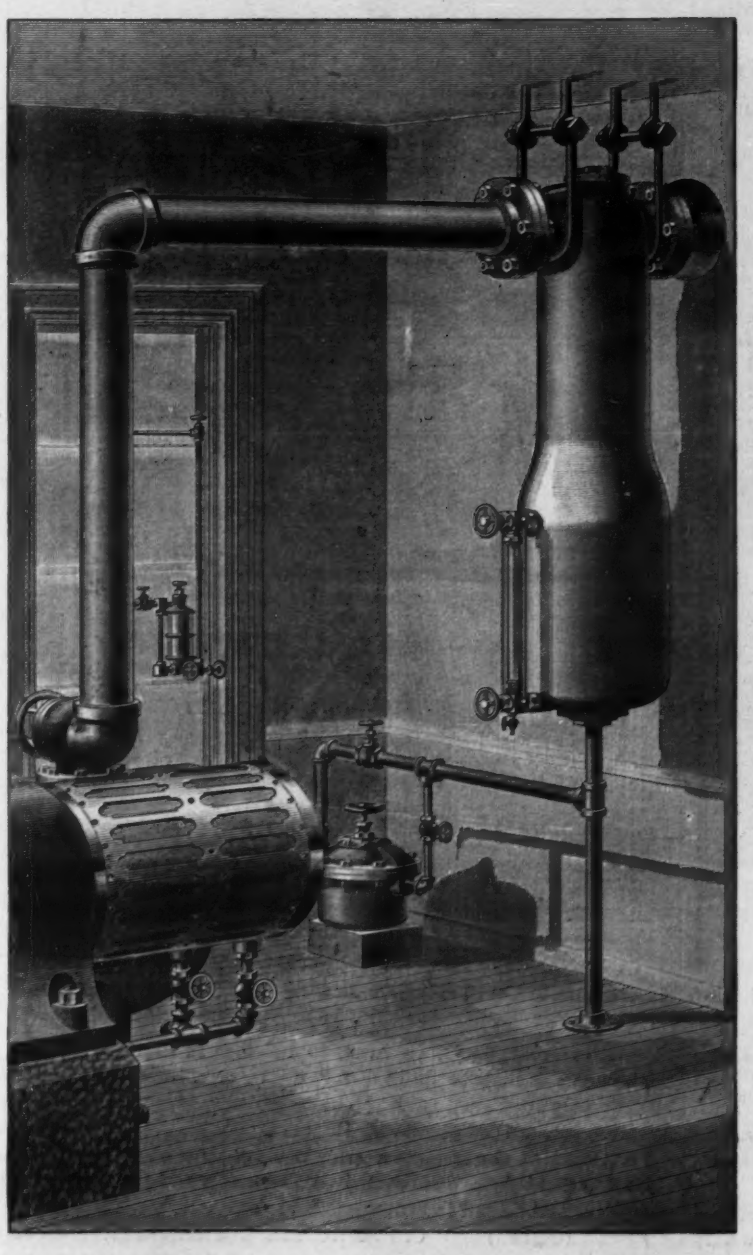
The Stratton Steam Separator.

Those in charge of electric light stations fully appreciate the advantages of dry steam, and will be interested in the Stratton steam separator illustrated on this page, the object of the device being to separate the water from the steam and deliver dry steam to the engine.

The perspective view, Fig. 1, shows the method of connecting the separator. The top of the separator is placed in the steam-supply pipe as near the engine as may be convenient. From the bottom of the separator extends a pipe leading to the sewer. A short distance from the separator this pipe is tapped to form a connection with a steam-trap having a suitable outlet. The water taken from the steam which is passing to the engine collects in the bottom of the separator, from which it is automatically drawn by the action of the trap. If from any cause the trap should refuse to work, the water may be drawn off by closing the valve in the pipe leading to the trap and then opening the valve in the main pipe. The construction of the separator is clearly shown in the sectional view, Fig. 2, from which also an idea may be obtained of the course taken by the steam in its passage through the separator. Depending centrally from the top of the separator is a cylindrical pipe which ends about at the middle of the shell. This pipe forms a continuation of the outlet pipe. The steam enters at the top of one side of this pipe, and in its downward journey follows a spiral course around the pipe. Naturally, the particles of water carried by the steam being the heavier, are thrown by centrifugal force against the sides of the shell, down which they trickle and collect at the bottom. The lower half of the shell is widened in order to prevent those particles which are still held in suspension by the steam from being carried out with it. The dry steam then passes upward through the cylinder and on to the engine. A glass gauge indicates the quantity of water collected, and tells when it should be drawn. For small sizes the separator is made in a single casting, as shown in both the perspective view and the section.

In the larger sizes of these separators, which are made by the Stratton Separator Company, of this city, the top is made of cast iron and the shell of riveted steel plates.





FIGS. 1 AND 2.—THE STRATTON SEPARATOR ATTACHED TO A STEAM PLANT.

Some Notes on Storage Batteries.

BY J. D. DALLAS.

Formerly it was the opinion of many electricians that over-charging of secondary cells was not injurious to the plates. While not being so destructive as over-discharging, it is, nevertheless, a source of great injury, more especially to the positive plates. Peroxide of lead is a powder, consequently there must be some material of a binding property in the positive plate, otherwise as soon as the plates began to form, they would slowly commence to fall to pieces. Sulphate of lead is a compound of a binding characteristic. The color of this is white and all cells contain it in greater or less quantities. During the charge, the hydrogen given off when the water is decomposed tends to reduce the sulphate, thereby increasing the specific gravity of the electrolyte. Consequently should this process of charging be prolonged, all the sulphate must eventually be reduced, and the grid begin to lose all its active material. Whenever the surface of the plates, more especially the negatives, presents a white appearance, it at once indicates the presence of too much sulphate. Cells presenting this appearance may be ones which have either been over-discharged, or cells which have been allowed to remain for some time without being charged after the discharge has taken place. A remedy frequently resorted to is to charge the cells at a very high rate. This process will, it is true, reduce the sulphate; but cells treated in this way almost invariably buckle on the discharge following. A remedy which is slow but effectual is to charge the cells at a slow rate, say half the best rate at which cells should be charged, viz., 25 milliampères per square inch of positive plate area. Charge the cells with half the normal number of ampère hours. Next discharge the cells slowly until about the normal number of ampère hours have been taken out; on recharging, the white sulphate will be found to have almost entirely disappeared. When a cell is in good condition the surface of the negative plates will present an appearance of a blue-gray slate color.

The specific gravity of the solution should, by preference, be not more than 1.200 when fully charged, otherwise the acid tends to slowly sulphate the plates. The rate of charge does not necessarily depend on the weight of the cell, but upon the area of the positive plates. Mr. Preece, in his address on accumulators, read before the Society of Arts, says: "The most general maximum rate is found to be that which discharges a cell in ten hours." This would be true were the thickness of all plates the same, about $\frac{3}{16}$ inch. Owing to a certain type of cell, having too thick plates to allow of its charge or discharge at a sufficiently rapid rate, it was condemned, although giving the required number of ampère hours of charge. The best rate at which a cell may be charged or discharged can be obtained as follows: Take the total number of square inches of positive plate area, divide by 20, and the result will be the best rate of charge. The above rate has been determined, after long practice, to be fairly accurate. Let us take an example: Suppose that we have a cell of 15 plates, 8 negative and 7 positive; let them be of an area of $8\frac{1}{2}$ inches by $9\frac{1}{2}$ inches and of a thickness of $\frac{1}{16}$ inch. The total number of square inches is 565.25, which gives as a result 28.262 ampères as the best rate of charge. The maximum safe rate of charge has not yet been satisfactorily determined, but it should not be greater than 70 milliampères per square inch; and if we take the above cell this gives as the maximum safe rate of charge 39 ampères.

The following problem is one which is frequently asked: How many cells are required to run a certain number of lamps for a certain number of hours? Suppose that the lamps number 70 of 110 volts, taking 0.54 ampère, and are to burn for eight hours.

Let N = the number required,
V = the voltage of lamps,
n = the number of lamps,
t = the number of hours.

The number of cells must be half of the voltage of the lamps, as each cell is of an E. M. F. of 2 volts, plus a constant which is generally 3 or 4 cells, so as to allow for the fall of potential on the wire, etc. The number of series will depend on the number of lamps, the current which each lamp takes, and on the time directly. On the capacity of the cells the number of series will depend indirectly.

Then we have:

$$N = \left(\frac{V}{2} + 4\right) \times \frac{n \times c \times t}{300}.$$

With cells weighing about 95 pounds, or a little more, the constant will be 300; in the case of those weighing 45 pounds it will be about 150.

Solving, we have:

$$N = \left(\frac{110}{2} + 4\right) \times \frac{70 \times .54 \times 8}{300} = 59 \times 1 \text{ (approx.)}.$$

Showing that 59 cells in one series are the required number of cells.

This formula will not hold good in all cases. Let us take an example. Let all other conditions be the same, but instead of having a capacity to run only 70, we have now increased the number of lamps to 120.

Then we have:

$$N = \left(\frac{110}{2} + 4\right) \times \frac{120 \times .54 \times 7}{300} = 59 \times 1.5.$$

That is to say, one series would not be sufficient, and, on the other hand, two would have too great a capacity. Let us try another type of cell whose capacity is 150. Our problem is now solved.

It shows that 59 cells in series are required, and that the number of series must be three. So that the total number cells will be 177.

Another problem often asked is, How many horse-power hours does a cell of 300 ampère hours contain? To solve this in a satisfactory manner we must first determine what is the average electromotive force of a secondary cell. A fully charged cell has a working electromotive force (I say advisedly *working*) of 2.2 volts, which, when the cells are discharged, falls to 1.8 volts per cell. The average, consequently, may be taken as approximately 2 volts. By multiplying the number of ampère hours by 2 we shall get the work which each cell does in watt hours. Let us still take the cell whose capacity is 300 ampère hours; then we have $300 \times 2 = 600$ watt hours. To convert this into horse-power hours it is only necessary to divide by 746, so that a cell whose capacity is 300 ampère hours contains $\frac{600}{746}$ of a horse-power hour = 0.8 approx. h. p. hour.

Decisions Affecting the Telegraph.

Judge Moran, July 2, in the Appellate Court of Illinois, affirmed the decision of the lower court, which gave Charles D. Lathrop & Co. damages against the Postal Telegraph Company for the incorrect transmission of a dispatch to New York relating to the purchase and sale of coffee. The defense claimed that they could not be held for damages because the transaction was a gambling one, and they were not informed of the importance of the dispatch. The court could not agree with them.

Judge Phillips, of the United States District Court, at Kansas City, has decided that negotiable paper may be indorsed by telegraph, and that the indorser will be held.

Aluminum and Platinum.—The sixth report of the mineral resources of the United States states that the past year was more promising than ever before for the production of cheap aluminum. The production of metallic aluminum as an industry distinct from the production of alloys began toward the close of the year, and 500 pounds had been made up to Dec. 31; the production of 3,000 pounds since then indicates that the industry may continue. The exact amount of alloys produced by the Cowles process has not been furnished, but was not markedly different from the product of 1887, when 18,000 pounds of aluminum contained in bronze and ferro-aluminum were produced. The price for metallic aluminum declined to as low as $4.50 per pound for less favored brands. Including the platinum and iridium separated from gold by the assay offices, and that saved in placer gold mining the platinum product was about 500 ounces, valued at $2,000.

A Review of Mr. Harold P. Brown's Experiments.

To the Editors of The Electrical World:

For some time past wrong and misleading statements have been made with regard to the qualities of direct and alternating currents. They appeared in the form of a pamphlet, *in which it is said the tests and arguments had withstood the severest opposition. Not only is this manner of advertising one's wares by running down those of others the lowest imaginable method, but it assumes a very serious aspect, if it subsequently transpires that the tests are *not comparative tests.* They are wrong, misleading and not worth the paper they are written on, and to prove this, I beg you to find space for the following criticism in your esteemed journal.

One of the few trustworthy statements is to be found on page 5 of said pamphlet; it reads as follows: "It will not do for electricians to state that they don't know what killed that man, for, unless they take prompt measures to make their business safe, some terrible accident will cause the adoption of laws to regulate electric lighting, which, *being framed by their enemies, will cripple or destroy their business.*"

This open confession of the future action of Mr. Brown has caused me to look through his experiments, which I find to be wrong; the conclusions are based on bad experiments, consequently they are misleading and untrue. In two replies which I made on Sept 8 and Oct. 13, 1888, of this journal, I thought that Mr. Brown had learned so much of the subject as to distinguish the system of alternating currents *without* converters from the distribution *with* converters. He has shown himself totally incompetent to handle the question, and the framing of rules such as No. 4, No 5 and No. 6 shows this.

Rule No. 4 reads as follows: "No arc light dynamo shall be operated unless provided with means for automatically stopping the production of current the instant a ground connection is made upon its circuit."

Let us now see how the thing operates. We will use for example an Edison municipal dynamo, referred to by Mr. Brown as being safe with an overhead circuit, when provided with Mr. Brown's so-called automatic safety device; let us assume that a telegragh wire drops on the line and causes a ground. The relay works instantly and cuts off the current. A policeman, well acquainted with the great safety qualities of the closed coil armature of the Edison dynamo, made still "safer" by the Brown automatic device, thinking that there is now absolutely nothing to fear, lifts up the wire to bind it round the nearest post. In doing so he breaks the second ground for an instant, the automatic device is released, the dynamo again fully excited, and a sudden discharge takes place through telegraph wire and policeman to ground. As soon as the man drops to the ground the wire will re-establish a proper earth connection, and the safety device instantly stops the generation of current; but the damage is done. The safety device seems to possess the good qualities as long as it is not applied.

Rule No. 5 represents a perhaps not quite unnecessary precaution in the event of the breaking of a main line. I have never heard of such a thing yet, but I can imagine that this rule has been especially designed for Mayor Grant. The only time that electric light wires fell from the poles was caused recently by vandalism under the strain of the weighty "corporation," the Board of Electrical Control. Rule No. 6 is *intended* to reduce the danger of alternating current distribution, while in reality it has the opposite effect, as proved in the numbers of this journal above mentioned, the correctness of which has not been questioned. There is no doubt about the great depth of the thoughts expressed in these rules; they are so deep that we cannot grasp them.

Coming now to the experiments, we find the first two tests of direct and alternating currents to have identical effects. This is natural; but in some of the following ones, safety devices are introduced in the direct current to prevent the extra current from reaching the animal, and not introduced in the alternating current. Further, did the experimenters never stop to think that the potential they measured with the Cardew was smaller than the actual alternating current pressure which naturally must have risen at every make and break? Did they consider it just to compare two currents in which a certain effect in one case is eliminated while the same effect in another has not been removed?

For direct current experiments a shunt wound dynamo is used capable of producing at full load a pressure of 1,500 volts. To prevent killing, the current had been increased *gradually.* At maximum load the existing current in the field may be 5, 6 or 7 ampéres. What degree of excitation will be found in this 1,500 volt dynamo when there is no external load and 200, 400, and even 600 volts are produced on open circuit or across a very high resistance? Could there be a large discharge of current if there were a chance for it? No. None of these conditions exist in practice. The Edison municipal dynamo when working with 1,000 to 1,500 volts has a heavy current in the armature and would discharge it, if the resistance of an animal placed in the circuit has been reduced under the influence of the pressure. Therefore, experiments 5, 6, 7 and 8 are contrary to facts and normal conditions, especially since the continuous current flow produced by the safety device cannot be compared with any condition of ground or fault in a circuit.

If the dynamo were supplied with the relay and a telegraph wire makes a ground connection, is the discharge current from the Edison dynamo or circuit equivalent to the continuous current flow? Is it not a sudden discharge? How then can these experiments be made to compare with practice? If circuits are left alone there is no danger in them; if there are faults, discharges, grounds, etc., the change is sudden. Where, in any distribution in existence, do we find this continuous current when accidents occur? Nowhere.

For the direct current experiments we find properly laid out conditions all favorable to the pursuit of the desired object, but none of the said conditions are normal, nor do they appear in practice.

While the change of excitation in the Edison dynamo has varied (probably) from one-sixth ($\frac{1}{6}$) to one-half ($\frac{1}{2}$) of the normal, the alternating current dynamo is fully excited, or nearly so, for all loads. This also is not a condition in practice. Generally the speed is maintained constant, while the excitation is raised as the load increases. Neither has it been considered necessary to place converters in parallel to the object to be protected across the poles of the dynamo.

Having now pointed out some of the main differences of the so-called "comparative tests" I quote the following lines of the report of the Committee of the Medico-Legal Society: "Some experiments were conducted by one of our committee (Dr. J. Mount Bleyer), and reported in Humboldt's Scientific Library, March, 1887, and during the past summer a series of thirty or more *careful* experiments were made upon dogs with death currents, at the Edison Laboratory, in New Jersey, by Messrs. H. P. Brown and A. E. Kennelly and the chairman of this committee (Dr. Frederick Peterson), all of which are of particular value to us in suggesting the proper method of executing criminals by electricity. These last were published in detail in THE ELECTRICAL WORLD, August 8, 1888, and from them we have ascertained the following points:

"The resistance of the dogs was measured and found to vary from 3,600 to 200,000 ohms, depending upon the different thickness of skin and hair, and the amount of moisture between the skin and electrodes. *The amount of electromotive force was also accurately determined, and it was found that with the alternating current as low as* 160 *volts was sufficient to kill a dog, and that with the continuous current a much higher voltage was necessary to the production of a fatal effect.*"

It is a pity that authorities like Drs. Frederick Peterson, R. Ogden Doremus, Frank H. Ingram and J. Mount Bleyer should form such a rash judgment upon a subject on which they are not thoroughly informed, by pronouncing the alternating current more dangerous; these gentlemen have been misled and deceived by wrong experiments. The direct current dynamo could not act better, as there was not sufficient current or power in it; the machine had been excited at an average of about one-third of the normal excitation without any load, and discharged under unnatural conditions. A discharge current, as, for example, in the case of the boy Streifer, in this city, has not this continuous current flow; consequently the conclusions derived from experiments 5, 6, 7 and 8 are wrong.

These experiments have been made for the purpose of making it appear that with the direct current death is uncertain, and the experimenters caught their doctors very well indeed; for the sake of justice they ought to have stated that in this form (Exp. 5, 6, 7 and 8) the *direct* current is unnatural, as with all these pressures from, say, 200 to 1,500 volts, should a fault arise, the current changes its nature and takes properties identical with those of the alternating current.

Referring to the number of accidents, we read that there are fifteen fatal cases and several severely injured people; but what is this number compared with the blessing which this new industry has imparted to millions of people. It is certainly true that reckless work has been done, and is still being done, on account of carelessness and an intermediate trade existing between manufacturers and local companies. The constructing agents very often do the mischief. A certain price is stipulated for by the firm to carry out a certain plant, and to make as much money as possible by the transaction, cheap material is used and bad and careless work done for the sake of saving time. I wish to draw attention to the fact that, in a single town like Chicago, there are in one year more accidents in the building of houses, and more accidents on railroads in New York City, than the number above stated; and while this number refers to two cities only, Mr. Brown has the scope of the whole earth to find the victims of the alternating current systems. There have been hundreds of accidents with elevators; are they therefore considered dangerous? Have they been abandoned? No. They are introduced more now than ever before, but better construction and more careful work is done. Can we place the alternating current distribution, by means of converters, among the *dangerous products of engineering* as has been represented by Mr. Brown and others? No. Any indirect system of distribution is safer than any direct distribution. It is held that the alternating distribution by means of converters is the safest distribution in existence, safer even than the Edison system, and this will be proved by Mr. Brown's own experiments hereafter.

Under such contradictory statements it is strange to read the following lines: "In every city having a large alternating current station many crippled pensioners of the same can be found." This is a statement as bold and untrue as it could be made. New York City has the largest alternating current station in the country, but there has not been a single fatality caused by the alternating current, nor are there to be found any crippled attendants or pensioners. Mr. Brown seems to be well posted, and to show how little I know about it I beg him, in his probable reply, to state the whole list of killed and wounded in this city.

Such statements as this and rules like No. 6, having the purpose of ruining the safest of all systems of distribution, show the true character of the campaign. If the pressure would have been reduced by law the trade would have been ruined and the danger increased. To increase the safety in any indirect system the pressure should be raised from 1,000 to 2,000 volts or more. The correctness of this statement is proved by the fact that in the stations in England, France, Germany, Switzerland, Italy, Spain, Austria, Hungary, South America, etc., there has been, during five years' constant work, not a single fatality, the pressure employed varying from 2,400 to 3,000 volts. The cause of so many accidents in the United States is very plain. The enormous demand for the new machinery, which will increase still more as soon as the alternating current motor is a commercial success, could at no time be met, and there has always been a lack of experienced men competent to do the new work. Linemen have been busily engaged in all branches, and, consequently, laborers were trained to become linemen, picking up during their work just what they could. With such an inexperienced force at command and inferior material, no model work could be carried out. Added to this, the circumstance that telegraph, telephone, messenger call, automatic fire alarm companies, etc., could string their wires just as they pleased and of any desired size, it cannot be surprising that these accidents have occurred. To blame the alternating current, therefore, for accidents arising from a chaos of wires is ridiculous.

Instead of blaming the constructors for their bad work the fault is found with the system in the same manner as a bad or untrained workman would find fault with a good tool he is not competent to use.

Returning once more to the experiments, Nos. 21, 22, 23, 24, 25 and 26 are misrepresentations. The circuit connections are not given, and it is maintained that the pressure, instead of being 250, 181, 110, 150 volts, etc., has varied between 800 to 1,200 volts. How do these experiments agree with the latest converter tests in which it has not been possible under the circumstances to kill any of the animals operated on?

Next let us take the grand comparison of currents by Dr. Frederick Peterson. He is certainly correct in stating that an alternating current of a certain potential will be as disagreeable to take as a continuous current of twice the pressure, but the conclusion made that the machines generating these currents or the circuits which distribute them stand with regard to safety in the *same* proportion to one another is entirely wrong. He would be correct if the continuous current remained of the same nature under all circumstances, but as is well-known, as soon as a ground, a short circuit, or the like occurs, we have no longer to deal with a continuous current, even if the dynamo is an Edison machine, and even if the current in the circuit is usually continuous. In the case of a good ground from a telegraph wire we have to deal with an oscillating discharge current backed up by a pressure higher than that generally or normally generated by the machine; consequently a 1,000-volt continuous current Edison machine will discharge an oscillating current with a pressure of over 1,000 volts, and is as dangerous as a pulsating or alternating current dynamo of 1,000 volts. A discharge current of 1,000 volts, alternating or oscillating, has an identical effect. It is self-evident that our learned doctor supposed the current to be always continuous, as he is accustomed to work with primary batteries, and has also been misled by the unnatural conditions of experiments 5, 6, 7 and 8 of the pamphlet. His conclusions are based on conditions which in practice do not exist; consequently they are false.

Having now shown that there is as much danger in a 1,000 volt continuous current dynamo as in an alterating or pulsating current machine, we must not conclude from this that the distributions are equally safe, or produce the same effect with regard to faults which may arise.

With the same fault, such as a sudden heavy ground, or similar change which arises on the three circuits, the greatest danger is caused by the direct current circuit; next comes the pulsating current circuit: and last the circuit of alternating current distribution by means of converters. Should Dr. Peterson maintain his statement and have the least doubt about mine I shall be glad to prove it to him; nothing is better than practical demonstration carried out in a just and natural manner. He says further: "It is in fact startling to see how small a quantity of E. M. F. is required, provided the alternations of the current be multiplied." This is the first time that a new law is expressed for electro-dynamic currents. Hitherto it was known that the E. M. F., among other things, *increases,* in proportion as the speed or rate of change per unit of time increases. There has been no load on the dynamo, while the field has always been fairly well excited; consequently when the number of alternations are increased the armature passes the field poles at a higher rate of speed, and also a higher E. M. F. is produced, which has proved fatal. It will, of course, be said that the excitation has been considerably reduced, but the instrument indicates only the average pressure, which is much smaller than the maximum on account of the short time interval; but Dr. Peterson, himself, has explained that the effect is caused by the rate of change from maximum to minimum, and consequently the reading of average voltage is a mistake. What remains then of the value of these experiments? This gentleman goes in for a comparison of dog butchering by two methods, in one of which a deflecting device is inserted in the circuit and in the other no device. These are "*thorough scientific researches,*" and, strange to say, the conclusions are just what suits his purpose.

Now, I must express my thanks to Mr. Brown for actually having used converters in his latest test, and what did he find? He could not kill a calf with a pressure which has been many times greater than that used in actual practice. The public comes in contact with an alternating current of 50 or 100 volts, and five to ten times as much (by the interposed converter) has been proved not to injure the person. I wish to impress upon the reader the great safety of the modern method of distribution by alternating current converters.

In earlier contributions I have tried to show the enormous difference of alternating current distribution obtained directly from the generator, or indirectly by means of converters. Mr. Brown himself has now proved this difference. It is certain that 1,000 volts pressure and one ampère, derived directly from the dynamo, will kill under very careful arrangements. Now, a small converter feeding 20 lamps requires this current, and these experimenters using large converters could not obtain the desired result. That these people did not know what they were doing, and do not understand the nature of a converter, is evident from the following statement: "The converter, which was deemed of insufficient capacity for the purpose, was then abandoned and the dynamo current used." Mr. Brown may vary the capacity of converters from a 5-light to a 500-light converter and more, and he will not be able under identical circumstances to obtain the result he desires, as the capacity of the converter does not enter into the question. He has strikingly proved how safe converters are, but could not imagine that the nature of a converter is similar to the safety device of which he thinks that a single one on an arc dynamo will make the system safe. How much safer must a converter distribution be if every converter has these main qualities? It is self-evident that every engineer, builder, bridge constructor, etc., should perform his work properly, as careless work in any branch may cause danger. It has been plainly demonstrated that these experimenters are totally unacquainted with the distribution by means of converters, and their qualities. How then can they pronounce them to be dangerous? They have shown that they could not kill calves by the indirect method of applying alternating currents, and what is the conclusion they came to? Here it is: "These experiments demonstrate beyond question that the alternating current is the best adapted for electric execution." A fine conclusion!

I could not help smiling after reading in the pamphlet, on page 61, the following words: "The alternating current has produced death at 160 volts pressure, while the alternating current electric light companies are using 1,000, 1,200 and even 2,000 volts. Their tendency is to constantly increase the pressure; even 10,000 volts is to be used in a proposed installation."

Thinking over this paragraph a vision rose before my eyes. I saw Mr. Brown with a terror-stricken face, both hands held straight in front of him, to stop a rapidly-advancing avalanche. I shook my head. It is impossible

* The Comparative Danger to Life of the Alternating and Continuous Electrical Currents.

for him to stop it; either he has to run with the same speed or else fall. Just as powerless will he be in this case to prevent the rapid strides of development of engineering and science; if he does not want to advance with the time then he will be a dead spirit of the past. As stated before, in indirect distributions, *that is the safest disposition in which the difference in the pressure of the source and that in the supply circuit is the greatest*, and Mr. Ferranti in England has made a move in the right direction, and is going to carry out one of the finest pieces of electrical engineering. Even should his first conductor not prove a success he *will* and *must* make it a success.

Present and future engineering point out the way towards indirect secondary, tertiary, etc., distributions, and just as much as we laugh now at people proposing electric light and power by primary batteries, as compared with the dynamos, just so does the advanced engineer pity the advocates of low tension direct distribution. There is only the choice for electrical engineers between the indirect distributions, all of which have high tension primaries. These systems are distribution by accumulators, direct current transformers, alternating current transformers and condensers.

Mr. Brown has done good work so far as the removing of bad overhead wires is concerned, but when he leaves the truth, and, intentionally or otherwise, makes false statements and misleads the public, then it is necessary to stop him.

Every disinterested electrician must conclude that the alternating current is as safe as any system in existence, and naturally would be a great rival to established systems.

LUDWIG GUTMANN.

NEW YORK.

Causes of Death from Accident in New York City.

We have been favored by Dr. Schuyler S. Wheeler, the efficient expert of the Board of Electrical Control, with the following classified statistics of deaths from accidental causes occurring in the city of New York during the year ending Dec. 31, 1888, made up from information contained in a communication from the Health Department to the Secretary of the Board of Electrical Control, dated July 2, 1889.

Fractures and contusions		154
Including,		
While tobogganing	1	
By falling walls and buildings	4	
By being trampled on at fire	1	
By machinery	7	
By fall of heavy bodies	46	
On railways	13	
By collision on El. R. R.	1	
By kick of horse	6	
Wave on S. S. "Umbria"	1	
By horse cars	8	
By explosions of powder	2	
By runaway wagons	2	
Drowning		173
Neglect and exposure		9
Falls		391
Including,		
While wrestling	1	
Through hatchways and elevator shafts	31	
Through broken rail of balcony	1	
From Tally Ho coach	1	
From carts and wagons	8	
Knocked down by running child	1	
Into hold of vessel	2	
On roller skates	1	
Down aqueduct shaft	1	
Burns and scalds		122
Including,		
By careless use of kerosine	17	
By explosions	11	
By smoking in bed	1	
At fire	13	
Suffocation		85
Including,		
Laid upon by parent in bed	21	
At fires	30	
By food	4	
By foul air in bunk of vessel	1	
By illuminating gas	14	
Sat upon by father	1	
By caving in of subway work	2	
Poison		173
Including,		
By lead	1	
By opium	12	
By mercury	1	
By chloral	1	
By ether during surgical operation	1	
By illuminating gas	18	
By carbolic acid	6	
By chlorate of potash	3	
By arsenic	3	
Killed by vehicles in street, exclusive of horse cars		55
Run over railways, including 14 by horse cars		64
Killed by electric light wires		5
Killed by explosions of cartridges		3
Killed by self-produced abortion		3
Wounds		21
Including,		
By kick of horse	2	
By swallowing glass from broken nursing bottle	1	
Total deaths		1,258

The Westinghouse Consolidation.

With regard to the proposed consolidation of Westinghouse electrical interests, announced by us last week, a special dispatch from Pittsburgh of July 3 says:

Unusual interest attaches to the meeting of the stockholders of the Westinghouse Electric Company, to be held on the 11th inst., to consider the proposed consolidation of that corporation and its owned and controlled companies. Under the title of the "Westinghouse Electric and Manufacturing Company," George Westinghouse, Jr., has issued a circular in which he announces that the contract which the company secured for the erection of a big electric light plant in London led to the formation of an English company. Nearly three-fourths of the stock will be issued to the Pittsburgh company in return for its patents, etc., and the balance will be open to subscription by parties in England.

Mr. Westinghouse also states that his company and the Consolidated and the United States companies, which it leased, have during the last three months taken orders to the amount of $775,000. This is all preliminary to the statement that it is desirable to secure the control of other companies not yet in the fold, and to do so the Westinghouse Company should acquire, if possible, increased charter powers.

This opportunity is now afforded them, and the entire capital stock of the Chartiers Improvement Company, now called the Westinghouse Electric and Manufacturing Company, has been purchased. This company was created by a special act of the Pennsylvania legislature seventeen years ago, and supplies requisite powers wanted in the original charter under which the Westinghouse Electric Company is now being operated. To complete the purchase it is necessary that the outstanding stock of the Westinghouse Electric Company shall be exchanged for the stock of the Westinghouse Electric and Manufacturing Company, share for share. The capital stock of both companies is the same—$5,000,000.

The Extension of Electric Lighting.

Mr. John P. Barrett, the city electrician of Chicago, returned home recently after a trip of inspection made for the purpose of studying the various methods adopted for street lighting. Speaking of what he saw in different parts of the country, he says: "We first visited Detroit. It is lighted by elevated towers, from sixty to eighty feet high. If there is no foliage that system is good, but with foliage there is practically no light. The central station is a superb one, with a capacity of 1,100 lights. Buffalo we found lighted from street corner poles, two blocks apart, the overhead wire system being used exclusively. It is better lighted than Detroit with its elevated towers. They have a good new central station in Buffalo which cost $250,000. The internal arrangement, however, of the old station there is superior to the new. Boston is lighted principally by the Brush Electric Light Company, of that city, with 1,100 lights in service. The wires are all overhead, in the main part of the city over the house tops, in the suburbs on poles. They are just completing a new station there at a cost of $500,000. Their plant gives good satisfaction. The city pays 65 cents a night for light. Their new station is splendid, but is larger than we need in Chicago. Lynn, Mass., is lighted by a private corporation. They have a fine central station on which they alone expended $40,000. Providence, R. I., for a small city, is a marvel. The electric lighting has been so satisfactory that they are building a new station at a cost of $800,000. These figures cover only the land, building, engines and internal appliances. They are introducing a triple expansion engine, built in Milwaukee, of 1,000 h. p., though the present capacity is 300 lights. They are building for the future. In New York we found two stations being reconstructed. The Manhattan Electric Light Company, incandescent exclusively, is spending $600,000 on a new station. The Westinghouse people, of Pittsburgh, are also reconstructing their station in New York at a cost of $500,000. They are taking their wires from poles and stretching them underground. The Mount Morris Station of New York, owned by two brothers, Germans, is being rebuilt at a cost of $800,000. That is one of the finest stations in the world. The United States Company is also spending several hundred thousand dollars there on improvements. They are all buying solid property and building for the future. We visited also Brooklyn, Philadelphia, Pittsburgh and Cincinnati. We found in all of them a repetition of the marvelous growth of electric lighting visible in other cities. The growth of electric lighting has evidently justified the enormous expenditures by those capitalists. All these cities are lighted by private corporations. Chicago is the only city doing its own lighting."

The National Electric Light Convention.

Secretary Garratt has issued the following important notice:

A special limited Pullman train, with dining and composite cars, will leave the foot of Chambers street, New York, via the Erie Railroad, on Monday, Aug. 5, at 9 o'clock A. M., for the accommodation of the members of this Association and their friends who will attend the convention at Niagara Falls, Aug. 6, 7 and 8.

One car will be reserved for gentlemen accompanied by ladies.

Tickets on this train, including Pullman service, will cost $10 each. Return tickets (to be obtained at Niagara Falls), including Pullman service, will cost $4.60 each.

As the cost of this train must be guaranteed the road, you are urged to remit $10 to the secretary at the earliest possible moment, for which you will receive your railway ticket and Pullman seat check by return mail.

Tickets may also be obtained at the office of the *Electrical Review*, 13 Park Row, and THE ELECTRICAL WORLD, Times Building.

Kindly write on the inclosed postal card the names of any of your friends, not members of the Association, who would be likely to go to the Niagara Falls Convention with the New York party.

A Farewell Dinner to Mr. H. Ward Leonard.

On Tuesday evening, July 2, writes our Western correspondent, an informal farewell dinner was tendered by some thirty of the members of the Chicago Electric Club to their worthy first vice-president, H. Ward Leonard, on the eve of his departure for New York, where he assumes the important duties of general manager of all the united Edison interests. The spread was served by Kinsley in the club's dining room, and Mr. B. E. Sunny kindly consented to act as chairman of the occasion, and so happily and judiciously did he fill the position that toast and song and story followed each other in rapid succession, and at its close the event was acknowledged to be one of the most pleasant in the history of the club.

Letters and telegrams were read from friends necessarily absent who would gladly have been present and participated in honoring their fellow member. Following are the names of the participants: H. Ward Leonard, A. Vance, John L. Martin, Theo. P. Bailey, George Cutter, George H. Bliss, F. S. Terry, D. P. Perry, M. A. Knapp, C. H. Wilmerding, B. E. Sunny, F. W. Horne, W. A. Kreidler, William Hood, Charles A. Brown, Charles E. Gregory, Ernst Hoefer, William Buckley, W. S. Andrews, Foree Bain, F. E. Degenhardt, E. Baggot, W. H. Fairclough, Charles Munson, C. K. Giles, A. H. Brown, Minnott Terrell, E. M. Izard, Lewis Nau, Frank Miller, Fred. DeLand.

Wednesday afternoon Mr. Leonard went east by the limited Lake Shore Express, many friends gathering at the depot to wish him Godspeed. Frank and jovial at all times, of great executive as well as technical ability, his departure cannot be other than a great loss to the electrical fraternity of Chicago and to the Electric Club. His papers read before that body have often been quoted from the world over. Chicago's loss is New York's gain.

The Chicago *Herald* of Tuesday morning paid its compliments to Mr. Leonard in an article from which the following paragraphs are taken:

"In the past few months all of the Edison interests have been united under one head, and the syndicate of capitalists holding the stock are a number of Germans represented by Mr. Villard, Drexel, Morgan & Co. and Mr. Edison and his party. These recognized in the young but vigorous frame and shapely head of the Chicago electrician a man fit to manage the great interest successfully and they called Mr. Leonard, as stated, to the general direction of their company, the United Edison Manufacturing. It is rare that merit is so quickly and so richly rewarded, especially in a field which is commonly supposed to demand long labor for the reaping of a harvest.

"Mr. Leonard is a very young man, being but twenty-seven years old, yet he carries a very wise and sagacious head upon his shoulders. Born at Cincinnati, he graduated from the Boston School of Technology in 1883, and entered at once into Mr. Edison's famous shops. In 1885 he came to Chicago as general superintendent of the Western Edison Company, and two years later resigned that position to go into business on his own account, the firm name being Leonard & Izard."

Electric Rapid Transit in Cleveland.

Among the cities which are rapidly coming to the front as leading in rapid transit facilities by the application of electricity, there is none, perhaps, where the advantages of electric power for street cars are more thoroughly recognized than Cleveland, Ohio. Though it is only about nine months since the first electric cars were put into operation upon the streets of that city, the Cleveland public have become enthusiastic over this method of transit, and the number of electric cars in this city is rapidly growing.

Last week a new extension to the East Cleveland Electric Railway was opened in Cleveland on Prospect street and Euclid avenue, and the first car was run over the line with the president and secretary of the road and electricians in charge as passengers. It is the intention of the East Cleveland Company to operate sixty motor cars on this line with two and a half minutes headway, and all horses will be removed from the line as soon as the motor cars are equipped with the Sprague motors which have been ordered. It is said that the experiment will be tried of running these cars at the rate of about eleven miles an hour through the city, and it is not thought that the City Council will object to this, since it is a well-known fact that electric cars operated at this speed are much safer to the general public than horse cars run at only six miles an hour, since the electric cars can be stopped very much more quickly than cars propelled by animal power. It is an interesting fact in connection with this road to note the popularity of the electric cars with the passengers and property owners along the line. In Cleveland, at a public meeting recently, which was presided over by some of the most prominent citizens, resolutions were passed commenting on the successful operation of the Sprague electric road, and the East Cleveland Company was requested to extend the motor line in several directions in order to improve the transit facilities. These resolutions were adopted unanimously by the large number of citizens present.

The equipment of the East Cleveland Company includes, besides a number of the old type of Sprague motors, a number of cars equipped with the new style of motors, and the additions to the equipment will all be of this class of motors. Cleveland deserves a prominent place among the leading "electrical cities" on this continent.

A Pioneer Electric Line Reorganized at Binghamton, N. Y.

One of the first electric street railways in this country, the Washington Street, Asylum and Park Railway of Binghamton, N. Y., has recently had its entire equipment changed, in order to meet the latest and most approved ideas in electric railway practice. The first equipment was installed about two years ago, and the changes which are being made illustrate the advances which have been accomplished in electric railway work, and they show the difference between the ideas which were prevalent two years ago, and the leading ideas as illustrated in the motor appliances of to-day. The motor cab, which occupied the front of the car under the old style of electric railway, will be entirely dispensed with, and the motors will be placed underneath the cars, as in all the modern electric street railways. The overhead "over running" trolley and the method of carrying all the current over the track on a single conductor has been abandoned for the latest Sprague methods in this case. The motive power also will be under the more complete control of the driver, and all degrees of speed in both directions are obtainable by movements of a single switch, so that the car can be propelled either backwards or forwards with equal ease and rapidity. The cable lines which it was found necessary to operate at either end of the road on account of the heavy grades at these points, will be things of the past, as the Sprague motors will be of sufficient power to propel the cars up these grades, and the trip from one end of the line to the other will be made without change.

It is interesting to note the increase of efficiency of the motors as indicated by the statement which is made that the management of the railway company has completed a contract for power at nearly one-half less than the amount called for by the previous contract.

The cars will each be equipped with the new Sprague motors of 15 h. p. each, and with all the latest improvements and devices in use by the Sprague Company upon any of the roads equipped by their machines. These cars will each be able to tow one ordinary car. The reorganization and re-equipment of this road is applauded by the citizens and papers of Binghamton, who anticipate improved rapid transit facilities on the new road.

Some Results with Secondary Batteries in Train Lighting.

The following is the discussion which took place on Mr. Alex. S. Brown's paper, entitled as above, read before the annual meeting of the American Institute of Electrical Engineers:*

Mr. Geo. B. PRESCOTT, Jr.: I think Mr. Brown's paper is very interesting, and I am sure the Pennsylvania Railroad Company deserve a great deal of credit for making the experiments which they have made. I think that these tests which the Pennsylvania Railroad have made have demonstrated one thing very positively, and that is, that an accumulator made entirely on the Planté principle, without active material applied according to the Faure method, is an impracticable battery for commercial purposes. Whenever the accumulators have been properly installed and have been treated as if they were features of machinery that were worthy of being properly cared for, they have been very reliable and they certainly fulfill certain conditions that no other electrical machinery does fulfill to-day.

The improvements in the use of electrical accumulators are not confined to the cells themselves. No matter how good an accumulator may be, if it is not properly installed with suitable apparatus for regulating both the charge and discharge, it will never give satisfactory results. If the accumulator is overcharged, the paste is reduced or, rather, it is peroxidized to such a high degree that it becomes a very fine powder and has not sufficient consistency to hold together, and it simply floats in the form of a powder and gradually deposits in the bottom of the jar. That comes from overcharging, and yet it was only a year ago that it was thought that overcharging improved accumulators. We know now, too, that if the cells are allowed to overcharge they become very heavily sulphated, and the longer they stand in a discharged state the more dense this sulphate becomes, and then if the charging is commenced at what would otherwise be the normal rate the gas seems to be developed within the interstices of the pellets, and as the sulphate is not in a condition to take up the oxygen, it is liberated, and the result is that these pellets are forced right off the perforations in chunks, so to speak. If, however, the cells are charged and discharged within certain limits, which can be determined for every size of cell, and if any short circuits that may occur through accident or other cause are removed at once, the accumulator to-day is a perfectly reliable piece of apparatus.

Mr. MAILLOUX: I would like to ask Mr. Brown whether the charging of accumulators at either of the termini of the road has been definitely abandoned in favor of the system of charging on the train. I ask this question because I know that on some roads there is a very great and decided objection to deriving the energy for charging the batteries from the locomotive. That is particularly the case with the Boston & Albany Railroad. I once had occasion to discuss the matter with the president of the company, and he would not entertain at all any project for charging the batteries on the road, for the reason, as he said, that they needed all the energy, whether they used it in the form of steam or derived it from the axle for propelling the train itself, their object being to make the shortest time; in other words, to maintain their trains in the condition of the best express service. I would also like to ask another question about the latest modifications. Mr. Brown spoke of the fact that a smaller battery was able to do the work. I do not exactly understand in what way it could be unless it were that he was enabled to use lamps of a higher efficiency, giving the same candle power with a smaller rate of expenditure of energy. I would like to have him elucidate that matter for us.

Mr. BROWN: In regard to the charging of batteries on a car or at the terminus, you will understand that the Pennsylvania Railroad still charge at Jersey City. It was the Pullman Company I alluded to; they have done away altogether with the charging at either terminus, with the exception of keeping a few spare cells both at Jersey City and Chicago, so that in case the train arrives in Jersey City in the evening, and anything is the matter with the cells, or the trays, we simply have a good tray ready to put in its place. In regard to the lamps I spoke of using a battery, with a less number of cells, when we were using twenty-four cells of the Electrical Accumulator Company's battery we would get about 14 or 15 hours' light, using the Brush-Swan lamps, 45 volts. When we changed and commenced using 23 or 24 volt lamps and 12 cells, we got about 7 hours' work. You see it was just about the same thing, and we found it was easier, although we did not increase the number of hours, to change the cells a little oftener and use a less number of trays, and at the same time we had to keep a less number of cells on hand in the battery room. We found it more economical in both ways to work it in that manner.

Mr. W. H. PEIRCE: I would like to ask what the weight of those cells per lamp was, and if there have ever been any experiments tending to show the quantity of steam used.

Mr. BROWN: I really cannot say very much about the Pullman work, because I am not connected with that company in any way. I do not know just how much steam they require. But in regard to the other matter, the lamps, I supposed it to be a 16 candle power lamp; that is what they are held up to. Of course, they may fall off a little bit, but when the battery is properly charged they seem to hold right up. We have no method of testing in Jersey City, but that is what they are rated at. The weight of a cell is about 50 pounds.

Mr. PEIRCE: That goes round how many lamps?

Mr. BROWN: We use 10 lamps on a car. The weight of battery on a car is 600 pounds; we use 12 cells.

Mr. PRESCOTT: Mr. Mailloux referred to the objection that he had heard made by some railroad company to making use of steam for driving the dynamo. I think that that objection is not very well founded. We all know that the use of steam for heating purposes, for heating cars, is being universally adopted, and some steam could be used for driving a small engine to run the dynamo and the exhaust used for heating the car. On the other hand the amount of steam required to drive the small engine is such an almost infinitesimal part of the total amount of steam generated in a locomotive boiler that it need hardly to be taken into account.

Prof. E. L. NICHOLS: I should like to inquire of the author of this paper whether he can tell us anything about the average life of accumulator cells used in railway service as compared with the life of the same type of cells doing the same amount of work when stationary. I have had this question asked me many times and have looked in vain for definite information concerning it.

Mr. BROWN: I am sorry that I cannot answer that question, because I have never had any experience with stationary cells. My experience has been confined entirely to railroad cells. We calculate our positive plates to last about a year. They are in use almost all the time. Of course they have a great deal rougher usage than the stationary cells, although I do not think that the motion of the train does them any harm at all. We do not find that the batteries splash any. Of course, there is some little motion, but being in the centre of the car—they are very long cars, about 65 feet in length—the motion there is very little, so that I do not think that that does any harm to it at all.

Mr. VAN SIZE: The details under consideration come more within the line of practical every-day contact with work with which I have had very little experience. I have heard it suggested, however, that there might be some considerations advanced in favor of the oscillatory motion due to use on a railroad car, because of the agitation of the liquid making a more even distribution; that is, the specific gravity would be more equal at all points of the cell, and while there might be some detrimental results from the shaking to which the material was objected, the difficulty in that direction would be perhaps more than made up by the equal diffusion of the electrolyte. I do not know that any tests have ever been made to determine this question. As to the question which Professor Nichols asked relative to the duration of a cell whose life was spent upon a car as compared with that used in stationary work, I do not know that it has been determined; but the general opinion is, so far as my experience goes, that the railway cell has a somewhat abbreviated life. The varied attention which the two classes of cells receive would also determine that result to a certain extent. A cell in use on a railroad train would naturally receive a little more careful attention than a stationary cell, unless a system of inspection was in use in connection with the latter.

Mr. MAILLOUX: I may be able to give some information in that direction by reference to the experience on street car lines. The storage battery is never put to a more crucial test than it is put to upon a street car. The requirements of a source of supply of electricity for street car traction are, as everybody knows, very severe. My own experience and observation lead me to believe that if a battery on a car were submitted to the same rates of charge and discharge and to the same treatment it would last longer on a car or on a moving vehicle than in stationary places. I have seen the same battery when used in stationary work, and when in use on street cars and also in railroad cars. In street cars the work was always necessarily much more severe. There were times when the battery might have to withstand a current rate of from 50 to 100 ampères. While in stationary work the same battery would never have a current rate exceeding perhaps 25 to 35 ampères; and yet even under those very trying conditions I have known of batteries, the positive plates of which were still quite good after fifteen months' use—almost daily use. For a long time the plates were used daily at least once, and sometimes charged twice a day; and yet, after fifteen months' use, the active matter was not sufficiently gone; in other words, the plates (of course, I refer to the positive plates, because the negatives were nearly as good as ever) were still good enough to do good work, and this would show that there must be something in the vibration or the shaking of the cells which counterbalances somewhat the hard usage which they receive in the way of excessive rates of either charge or discharge. The particular battery which I refer to was once discharged on short circuit, while on the road, by the bursting of an armature. One of the cars was going down the steep grade in the upper part of Madison avenue, and the man thought it would be splendid fun to coast down hill. I suppose he must have developed a speed of twenty miles or more, and one of the armature bands ruptured, and being only a street car man, he did not seem to think that that made much difference—perhaps he did not notice it. When he got to the bottom of the grade he very innocently turned the switch to put on the current. The car did not seem to move very fast, and he was made conscious that something had happened by the conductor telling him that something was smoking. The trap door was removed, and he found that one of the motors seemed to be burned up. So the car was brought back. It was an experimental car, and upon investigation I found that the current rate of discharge had been sufficient to burn up one of the connecting strips by which the circuit was closed from cell to cell. In other words, one of these strips had acted as a fusible plug, and from its area of section I concluded that the current rate must have exceeded 300 or 400 ampères. I also found that the field wire, which was about No. 4½ Brown & Sharpe, I think, had become heated sufficiently to char the insulation—to carbonize it almost entirely for the whole length—so I concluded from that that it must have had a fair rate of discharge. I naturally concluded that the batteries would be ruined, but I had them taken out and cleaned, and to my great surprise I found that while there was some active matter in the bottom of the cells, it was not at all, in quantity, what I expected. In fact, it was so little that I did not know how much of it was due to that immediate circumstance and how much was due to the wear and tear. At any rate, the batteries were put into the same cell, except two of them which were ruined by the melted lead flowing out where the circuit was broken by the falling metal of the safety plug. Shortly afterwards, the same battery was again short-circuited by some accident which occurred in the station itself while making connection with the machinery. It was short-circuited in such a way that only the field wire of one of the motors was put across the terminals and the connection seemed to be better this time, and we did not know of it until we heard a violent hissing noise. I jumped on the car—it was one o'clock at night—and struck a light and noticed that the solution was boiling in several of the cells; so I very quickly opened the circuit and we found that that had been discharging at a somewhat excessive rate. Again I thought the cells might be ruined, but I had them washed and cleaned and they did a good deal of work after that. In fact, I do not know how long they lasted after that. This goes to show that in the first place storage batteries will stand a much higher rate than they are generally supposed to, with comparative impunity, and it corroborates, perhaps, the belief which I have that when once the active matter of a storage battery has become thoroughly receptive by a proper course of treatment, either originally in the making or construction of the battery, or subsequently in the nursing or treatment of it, that you can do with it a great deal that would ordinarily be considered as abuse of a battery.

*THE ELECTRICAL WORLD, June 1, 1889.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, July 8, 1889.

Mr. C. Upham Ely, of 35 Dey street, reports the sales of the Brooklyn battery as very gratifying.

Mr. Henry W. Bates has opened New York offices for the Tropical American Telephone Company at 18 Cortlandt street.

Mr. J. Potter, the treasurer of the Brush Electric Company, has been recently occupied in New York attending to the affairs of that corporation.

Mr. Edward Lasell, the secretary and treasurer of the Southwestern Electrical Supply Company, was in town last week. His company has headquarters at Kansas City, and he reports a good state of trade at that excellent distributing point.

The Empire City Electric Company has just issued in Spanish an edition of its handsome catalogue of electrical specialties and supplies. It is a pretty and tasteful piece of work, and as an exhibition of American push and enterprise deserves to be richly rewarded.

Mr. A. B. Laurence has associated himself with the Shultz Belting Company, of St. Louis, makers of the celebrated Shultz patent fulled leather belt, and has opened office at 225 Pearl street and 1a Platt street. He has already a long list of large orders for Edison, Excelsior, Westinghouse and other plants.

Capt. Willard L. Candee, of the Okonite Company, returned home from Europe last week after a highly pleasant and successful trip, which included the Paris Exposition. Capt. Candee has already been given a reception by his command, Company B., of the Twenty-third Regiment, and has also been dined by his Brooklyn friends.

Mr. T. Guilleaume, of Felten & Guilleaume, the well-known European wire manufacturers, has been stopping at the Hoffman House. He is giving considerable attention to cable making. His firm are using one of John Robertson & Co.'s lead incasing machines, and he has just ordered an entire new set of dies to be made and shipped to Germany.

Mr. C. A. Benton has just formed the Dobbs Ferry Electric Light and Power Company at Dobbs Ferry on the Hudson. He will install American arc and Edison incandescent dynamos, and has secured the exclusive franchise for 5 years for the erection of poles and to string wires in the town. He has also secured a contract from the local authorities for lighting. It is said that this company will be given the lighting of Hastings, the adjoining town. This makes an important link in the lighting along the Hudson, and it is pertinent to recall the fact that all the rich people that way are wired up for the Edison system.

Waters Paper Construction Company.—Among the recently incorporated companies, under laws of New York, is the Waters Paper Construction Company, $300,000 capital, with offices at 115 Broadway, and factories at Troy. The object of the company is to absorb and increase the already large business of E. Waters & Sons, the well-known builders of paper racing shells, canoes, astronomical domes, paper for electrical purposes, and other specialities in paper construction which are covered by broad and valuable patents. The following list of prominent business men seems to assure success: Henry E. Irvine, Boston, President; Geo. A. Waters, Troy, Vice-President; Wm. Forse Scott, New York, Treasurer; Homer W. Hedge, New York, Secretary; Thos. Grimwood, New York, Director.

W. T. H.

ROCHESTER, July 5, 1889.

The New Thomson-Houston Roads.—The latest installation by the railway department of the Thomson-Houston Company is the Rochester Electric Railway, formally opened on the 3d inst. The road operated extends from the Big Ridge road, Rochester, to the Bartholomay Pavilion, in Charlotte, within a hundred yards of Lake Ontario. The length of the line is 4.63 miles; total track, 6.2 miles; maximum grade, 4 per cent. The equipment consists of eight motor cars, with two 15 h. p. motors each, and eight tow cars, all built by the John Stephenson Company, of New York. The power is supplied by two 80 h. p. generators run by two Woodbury self-contained engines of 125 h. p. each. Steam is furnished by two 150 h. p. boilers, with Jarvis settings. The immense crowds carried on this road on the Fourth of July furnished the means for a severe test as to the capabilities of the equipment. Needless to say the result was most satisfactory, and orders have been given to extend the wires to McCracken street in Rochester, and doubtless the service will soon be extended to the "Four Corners," the most densely crowded street intersection in Rochester. The work has been under the immediate supervision of Mr. W. N. Sheaff, of the Railway Department of the Thomson-Houston Company, to whom great credit is due for the successful completion of the work.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, July 6, 1889.

The Marr Construction Company have used over twenty-five tons of weatherproof line wire, for various installations, during the last month

Grafton and Upton, Mass.—These two towns will have an electric light station in common, using the Westinghouse system, and water power will be used.

Randolph, Mass.—The franchise for the lighting of this city has been secured by the Westinghouse Electric Company, and the work of construction will be commenced forthwith.

Cambridge, Mass.—At a regular meeting of the Cambridge Board of Aldermen an order was adopted granting permission to the New England Telephone and Telegraph Company to lay under ground conduits in several streets of the city.

The Standard Electric Time Company, of New Haven, have granted a license to the Cleveland Electric Manufacturing Company, of Cleveland, O., for the State of Ohio, for the sale of their electric time system. Mr. C. D. Warner reports that the demand for their clocks increases every day.

New England Electric Supply Company, Bridgeport, Conn.—Mr. Orford, the energetic manager of this company, tells me that business continues brisk in their many specialties, and that the demand for their patent rosette pendant is simply enormous. Mr. Orford cannot get material fast enough to fill his many orders.

H. W. Leach & Co. have now taken over all the contract business of Grant, Pearson & Co., now known as J. A. Grant & Co., and will continue to erect electric light plants and build power stations under their new name. Mr. Leach has been connected with the engine and boiler business for the past 20 years and is a thorough expert.

Mr. W. L. Adams, left Boston last Monday in the employ of the Marr Construction Company, to take charge of the wiring of the large river steamer "Kate Adams," now being built at Vanderberg, Ind. The Westinghouse direct current system will be used throughout, about 300 incandescent lights of 16 c. p. being distributed over the ship.

Wright Electrical Engineering Company.—Owing to the large increase in business enjoyed by this company, it has been found necessary to occupy more commodious quarters, and suitable rooms have been secured in the Estes Building, 196 Sumner street, Boston, where they will continue to push their business more energetically than ever, under the able and skillful management of Mr. A. P. Wright.

Spaulding & Buck.—Mr. Buck, of this firm, disappeared last week with all the cash he could lay his hands on, leaving Mr. Spaulding apparently to shoulder the consequences. Mr. Spaulding has not been seen for a few days, but he is expected in the city soon. Spaulding & Buck were the agents for the Eddy Electric Motor Company and the Continental Dynamo Company, and had good prospects of enjoying a prosperous business.

Newport, R. I.—The cottagers, having been unsuccessful in their first attack on the electric street car company, the Supreme Court having denied their petition for an injunction against th e

street railway company, have determined to appeal to the courts again. Further than furnishing the cottagers with some live topic of conversation, it is not thought that this action will affect in any way the success of the road or the ultimate welfare of Newport.

Middleboro, Mass.—The Marr Construction Company have completed their work of installing the Waterhouse arc light system, and the Middleboro Gas Company are now lighting the town with the Waterhouse arc lights, according to their contract. The incandescent machines have arrived, and the wiring for the incandescent lamps will be carried forward as fast as possible. No decision has yet been arrived at as regards the dispute between the two electric light companies.

Canton, Mass.—The Westinghouse Electric Company have been successful in securing the franchise for the lighting of this city, and work will be commenced in the next few days in providing the city with 34 arc lights and 72 incandescent lights. Some time ago the Selectmen granted permission for trial lights to the Westinghouse Electric Company and to the Thomson-Houston Electric Company, and the decision has been looked forward to with much interest by the townspeople.

Bangor, Me.—The Bangor Electric Lighting Company have determined to remove their plant from its present position in the centre of the city to Veazie, four miles further up the Penobscot River. Water power will be used, and it is expected that the change will be made in about three months' time. The electric street railway, operated by the same company, having met with signal success, will be extended considerably this fall, and more cars will be used to accommodate the passengers.

Mr. Albert Buttles Smith, accompanying Sr. Don Miguel Espinosa R., of Mérida, Yucatan, whom he represents, was in the city this week, looking up the merits of the Thomson-Houston system. Sr. Don Miguel Espinosa is a capitalist, and has secured an electric light franchise for the whole of Yucatàn. There are at present in that country about 115 arc lights of the Waterhouse system, and about 1,000 Westinghouse incandescent lamps, and it is now contemplated to put in a plant of 5,000 incandescent lamps, and 600 arc lights, with a capacity in the station for double that number.

The Aluminum Brass and Bronze Company, of Bridgeport, Conn., are rapidly pushing forward the construction of their new factory, and expect to get running by August or September. Meantime they are hard pushed to supply the numerous demands for their aluminum bronze and silicon bronze wires. The West End Railroad in Boston is using silicon bronze for the overhead contact wire in the electric railway, and the Sprague Electric Motor Company use it exclusively for that purpose. Mr. Fred. J. Kingsbury, Jr., expects a very large sale for this wire, as soon as they get ready to supply the trade.

Benedict & Burnham, Waterbury, Conn.—This firm so long and favorably known as manufacturers of underwriters wire, are now following the "signs of the times" by introducing a black waterproof line wire known as diamond "B" brand, and are already meeting a large demand for it. They are also introducing a good rubber insulated wire, which shows signs of becoming a very successful competitor of the many high grade wires already on the market. There still continues to be a great demand for their hard drawn copper wire for telegraph and telephone purposes, this specialty having become very favorably known in the past.

Mr. G. G. Stillman, agent for the Spencer damper regulator, reports the following sales: Assabat Manufacturing Company, Maynard, Mass.; Roxbury Carpet Company, Boston, Mass.; R. H. White & Co., Boston, Mass.; Jordan, Marsh & Co., Boston, Mass.; C. F. Hovey & Co., Boston, Mass.; Haile, Frost & Co., Hillsdale, N. H.; Abbott Downing Company, Concord, N. H.; N. Molterz's Sons, Providence, R. I.; L. W. Peckham, Providence, R. I.; Henry Adams, Rockville, Conn.; Goodyear Glove Manufacturing Company, Naugatuck, Conn.; Hollingsworth & Whitney, Gardiner, Me.; W. W. Cummer, Cadillac, Mich.; Andreas Sieno, Cienfuegos, Cuba.

The Plymouth & Kingston Street Railway, which has been recently equipped by the Thomson-Houston Electric Company, has just been put in operation. It is 4½ miles in length, and probably has more grades, in proportion to its length, than any street railway in the United States. There is one place in the road where the grade is 9 per cent. for 200 feet, increasing to 10 per cent. the next 200 feet. There are seven grades in all, respectively, 10, 9, 6.7, 6.4, 6.2, 5.8 and 5.2 per cent. The turnouts on this road are so arranged that while one car with tow in ascending a 10 per cent. grade, another is on a 5.8, throwing a heavy load on the generator, which, however, has been able to respond instantly to whatever demands have been made upon it The motor cars experience no difficulty in ascending these grades with heavy loads of passengers, and the entire operation of the road has been perfectly satisfactory.

Thomson-Houston Growth.—The Boston *Herald* says: "In speaking of the enormous business of the company, it may be said that 4½ years ago the secretary and four assistants, including an office boy, were sufficient to handle everything at the Boston office. To-day there are 90 people employed at the Atlantic avenue office, and the errand boys are more than the original force. At the former date there were 66 shareholders. To-day there are 596 of record, having an average shareholding of 201.34 shares. There are 120,000 shares in all. Oct. 1, 1883, there were 22 local electric light companies operating under this company, and they had 1,653 lights. Jan. 1, 1889, there were 406 local companies, operating 51,621 lights, not including 20 companies using incandescent apparatus only. Since Jan. 1 there have been many additions. There have been quarters in recent years when a new company was established every three days. The Boston office is to be enlarged, and the works at Lynn are being enlarged constantly. This company will get the contract with the West End Railroad. In addition to the above business, the company has its motor department and the international branch."

Crescent Beach, Mass.—The new rapid transit line from Crescent Beach to Winthrop Junction, Revere, Mass., equipped with the Thomson-Houston system, has just been put in operation. Owing to the nature of the soil the road-bed has been mainly placed on piling, and there is one stretch of bridge work of 2,400 feet. The entire length of the line is about 2 miles of double track. It has been constructed in the most thorough and reliable manner, is heavy enough to sustain ordinary steam traffic, and is of standard gauge 4 feet 8½ inches and laid with 56-pound steel T. rail. The company has constructed a motor and a car building at Crescent Beach, not far from the station of the North Shore Electric Company, which latter will furnish the electric power to operate the road. The equipment of the road, which, so far as the cars are concerned, is a summer one, consists of fourteen open cars, six of which are motor cars, the design being to run two or three cars in a train with motors. The trucks are supported upon four 32-inch wheels by steel axles of 3½ inches diameter. There are two motors for each car, each of which, with gearing, weighs 3½ tons, or 7 tons to the car. They are each of 15 h. p. capacity. The cars were built by the Newburyport Car Works, and are made in the best possible manner. No pains have been spared in the construction of this road, and it is of the same quality as is always found in those using the Thomson-Houston system.

The West End Street Railway Company, of Boston, which for some time past has been giving the best electric railway systems of the day a trial with a view to adopting one for its service, which has a greater mileage and number of cars than any other in the world, has just closed, with the Thomson-Houston Electric Company, probably the largest contract which has ever been executed for the electrical equipment of a surface railway. The West End Company will purchase the poles, set them and furnish the current for propelling the cars. The Thomson-Houston Electric Company will do the entire electrical construction and supply the motor trucks. The West End Company has purchased the extensive plant known as the Hinckley Locomotive Works, which it is proposed to convert into an immense power station of eight thousand or ten thousand horse-power capacity, for supplying current to its vast system. The plant comprises several large brick buildings, and is admirably suited for the purpose for which the West End Company propose using it. This company already owns one station which has been used for supplying the Brighton & Park Square line, and has been getting current from the Cambridge Electric Light Company for the Cambridge Division. The Thomson Houston system has been in operation on the Cambridge Division, which is one of the most heavily traveled routes, and which is acknowledged by the West End Company to be one of the worst pieces of track on the entire system. The operation of the cars on the Cambridge Division has been marked for reliability and freedom from all delays and breakdowns, and that they have demonstrated their superiority under such disadvantageous conditions is the best proof which can be offered of the capabilities of the Thomson-Houston system of electrical street car propulsion. A. C. S.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., July 6, 1889.

Chattanooga, Tenn.—A communication from President Johnson, of the Tennessee Electric Light Company, states that his company has adopted the Pennock system of underground conduits.

The Westinghouse Engine.—Messrs. M. R. Muckle, Jr., & Company, agents for the Westinghouse steam apparatus, have just received their thirty-first order for a 60 h. p. engine for the new sugar refinery of Claus Spreckels.

The Master Builders' Exchange, at the corner of Walnut and Dock streets, is being wired for 300 lights. The current will probably be taken from the street mains of the local Edison Company. All the offices in the building will be lighted complete.

Another Steamer Lighted.—The Gloucester Ferry Company have awarded the contract for a 90-light plant on their steamer "Sylvan Dell" to Messrs. Walker & Keppler, electrical constructors. The Edison system will be used. This is the fourth order this company have given the Edison people.

The Kensington Engine Works, Ltd., of Beach and Vienna streets, this city, have established a down-town office at No. 704 Arch street. The main offices of the company will still be at the old place, Beach and Vienna streets, where President H. C. Francis and Secretary William Francis can be found.

Vice-president Frank Thomson, of the Pennsylvania Railroad, who was rendered homeless by fire quite recently, is building a magnificent residence at Merion. Among the improvements to be introduced is the Edco system of electric lighting, for which 400 lights will be wired. The fixtures will be designed especially for this system, and will be both artistic and strong in design. It is thought that current will first be obtained from the Haverford Electric Light Company, but Mr. Thomson will eventually put in a plant of his own, together with a storage battery plant, both of which will be furnished by the Electro-Dynamic Company, of No. 224 Carter street, this city.

Lighting Camden, N. J.—The Lighting Committee of Camden City Council have awarded contracts for street lighting for the ensuing year as follows: Electric lights, Camden Lighting and Heating Company, 2,000 c. p., 40 cents per night. Gas lamps. Camden Gas Light Company, for 400 to 500 lamps, $19.80 per year each lamp. The Fort Wayne Jenney Electric Light Campany offered to erect poles and string wires and light the city with 2,000 c. p. lights for 30 cents per light all night. It seems to be an impossibility to seduce Camden away from her allegiance to the Thomson-Houston system of arc lighting. Lanterns, Pennsylvania Globe Gas Light Company, $2.47 each; same company lighting and keeping in repair naphtha lamps, $22 per lamp per year.

Partrick & Carter, makers of electrical supplies, at No. 114 South Second street, this city, have just issued an illustrated sheet, showing graphically the different styles of hotel annunciators and fire-alarm systems which are their specialties, and also the most improved manner of connecting and arranging the same for use. Appended is a list of hotels in which these apparatus have been installed, which is nearly a complete hotel register in itself. Every State and Territory is represented in this list. Canada has a score or more, and even the Sandwich Islands have been captured by a 120-needle Partrick & Carter hotel annunciator, which is hung in the leading hotel in Honolulu. It may be apropos to state in this connection that the Vanderbilt House, of Syracuse, N. Y., which was destroyed by fire a few days ago, was fully equipped with these annunciators and fire-alarm system, which proved the means of arousing the sleeping guests in time to make their escape from the burning building. Not a single life was lost. The catalogue is now ready for distribution.

The Electro-Dynamic Company, of No. 224 Carter street, this city, are exceedingly busy with their present contracts, and are pushing their work rapidly. They have just completed some work for the International Navigation Company, and installed at the company's Jersey City docks a 40 arc light plant and a 100 incandescent light plant, both of the Edco system. At the Washington street docks, in this city, they have erected for the same company 25 arc and 75 incandescent lights, also of the Edco system. At both these places everything has worked smoothly from the beginning, and little or no repairs have been made. This company has also a good business in storage batteries, and Mr. Paul, of the firm, states that they have already disposed of more than 12,000 in different parts of the country. The last storage battery installation was in the house of Mr. A. J. Cassatt, one of the directors of the Pennsylvania Railroad, at Nineteenth and Walnut streets, where 162 cells were placed. They are charged from an Edison circuit. The storage battery does not seem to be a failure.

The New Storage Battery Road.—The Lehigh Avenue Passenger Railway Company has purchased a tract of ground on Ridge avenue, near Huntingdon street, 198 feet on Ridge avenue, and running through to Thirty-fourth street, a depth of 200 feet. On this tract is being erected a substantial one-story brick station, with a frontage of 75 feet and a depth of 100 feet. A commodious power house, fitted up with boilers and machinery, will be attached to the main building. As only electric motor cars are to be used on Lehigh avenue, no provisions whatever are being made for horses The track approaches to the depot will be from Lehigh avenue, through what is now private ground, but which will eventually be Thirty-fourth street. It was the intention of the company at first to accept the offer of the Traction Company to temporarily use its stables on Lehigh avenue, near Front street, but it was finally decided to erect at once the station, which is now well advanced towards completion. Mr. William Wharton, Jr., under whose charge the management of the new road has been, said that these additional improvements had been the cause of the delay in the opening of the road to the public, and that it would probably be some weeks yet before it would be in operation. The new station will be just opposite the Ridge Avenue Station of the Park Suspension Bridge Railway, which it is proposed to run from the East to the West Park, and connect with the main line of the Gravity Road in the Park. The rolling stock of this road will be six cars fitted with the improved motor made by the Electric Car Company of America, the current being furnished by ninety storage cells of the Gibson type. The weight of these cars will be between 5,000 and 6,000 pounds. The grades on the line are not over 5 per cent. This will be purely an electric street railway. No provisions are being made for any other method of traction, and the results will be looked for with a great deal of interest by the street railway fraternity.

E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, July 6, 1889.

The Central Electric Company, Chicago, have secured the Western agency for the Eddy motor.

Peoria, Ill.—The Peoria Street Railway Company is to put in a fine electric railway plant on the Thomson-Houston system.

Luverne, Minn.—Messrs. J. A. Parroner, M. Webber and others have formed a local electric light company with a capital stock of $10,000.

Lincoln, Ill.—The Lincoln Electric Light Company has been formed by E. D. Blinn, J. T. Hoblut and A. J. Aldrich with a capital stock of $20,000.

Dundee, Ill.—The Dundee & Carpenterville Electric Light Company has been formed by W. Fay, A. Knott and B. Dorley, with a capital stock of $6,000.

The Municipal Electric Lighting Company, of St. Louis, has a capital stock of $750,000. Mr. Chas. Sutter, who has the big contract for city lighting, owns 74,000 shares.

The Northwestern Electrical Accumulator Company, Chicago, have been directed to "pursue a vigorous and aggressive policy in establishing their rights under the decision of Judge Coxe."

Wm. Baragwanath & Son, Chicago, have a cabinet in their office containing labeled specimens of scale and sediment taken from some of the steam plants they have installed, and which afford ample opportunity to study the character of depositions formed under various circumstances.

The Thomson-Houston Electric Company, Chicago, has sold the following isolated plants: Paul Cornell, hotel, Hyde Park, 350 incandescent; City of Milwaukee, for water-works plant, Milwaukee, Wis., 125 incandescent; Kansas State Sugar Company, Attica, Kan., 100 incandescent; St. Louis *Republic*, St. Louis, Mo., 300 incandescent; Academy of Music, Chicago, Ill., 16 arc and 400 incandescent. They have also sold to the following local companies: Fresno Gas Company, Fresno, Cal., 50 arc; Columbus Electric Light and Power Company, Columbus, O., 50 arc.

The Rose Polytechnic Institute, Terre Haute, Ind., ended its current academic year on the 20th ult., and the first term of the next academic year begins on Sept. 18 and ends Dec. 21, 1889. Prof. Thomas Gray, B. Sc., has charge of the dynamic engineering class, and the president, T. C. Mendenhall, LL. D., in referring to the special course in electricity, states that "it is believed that those who wish to fit themselves for the intelligent manufacture of electrical apparatus and machinery and for designing the same, or for the installation and management of electric light and power stations, for expert work in connection with telegraph and telephone service, etc., will especially need the greater part of the training which the course in mechanical engineering affords." He quotes from Sir William Thomson's address of Jan. 10, 1889, as follows: "Every young person who has a fancy for electricity thinks he would like to be an electrical engineer. They think electrical engineering as all ether and electricity. Now I have continually to impress upon anxious fathers and mothers that their boys must condescend to learn something of gross ponderable matter, and that electrical engineering is not confined to ether and electricity, but mechanics also is an essential part of the subject."

Nashville, Tenn.—The new electric railway at Nashville, Tenn., which is one of the roads recently equipped by the Thomson-Houston Electric Company, has been running now for some little time. This road is six and one-eight miles in length, half of which is laid out with Johnson rail, the other half, with the exception of about one-quarter of a mile, with 20-pound steel T-rail. There are thirteen curves on the line, and several grades, the steepest of which is 5½ per cent. In the overhead construction the cross suspension method has been used throughout. The cars are six in number and are each equipped with two 10 h. p. motors. They make on an average 475 miles per day. The power house is a large brick building, 175 x 70 feet, and contains two steel boilers built by the Phœnix Iron Works. The power house is built to allow a sufficient addition to bring the total horse power to 1,000. There are two Dick & Church 100 h. p. engines with pumps and station fittings for 800 h. p. The electrical equipment consists of two 80 h. p. generators, switchboard and necessary electrical appliances for operating the same. The stables and power house are lighted from the dynamos. The company is so much pleased with the operation of the system that it has decided to equip all its lines with electricity as soon as practicable. F. D

LOUISVILLE, Ky., July 3, 1889.

Mr. W. J. Ferris has resigned his position as superintendent of construction for the Gaynor Electric Company, of Louisville, Ky., to associate himself with the Central Thomson-Houston Company, and he will now represent that company as their agent in Ohio, Indiana and Kentucky.

"Drop a Nickel in the Slot" Battery.—Nearly everything in the shape of the "drop a nickel in the slot" machine has found its way to Louisville, but a newcomer is now here. This time it is a rival to the fakir at the street corner, with his old-time medical battery that will cure any and all diseases. The new machine stands in many prominent places in town, and one often sees a number of men and boys watching some fellow drop his nickel in the slot, take the handles and pull gently towards him, while all eyes are watching the indicator move over the dial, which is marked from one to four hundred, and when he holds it all the way round some promising 'Edison" remarks: "That fellar can take 400 volts." I am told

that one machine took in $18.35 last week, which is a very good interest on the money invested.

Mr. H. W. Driftmeyer, electrician for the Fort Wayne Jenney Company, has almost completed one of the finest electric light plants in the South, at the new Amphitheatre on Fourth avenue. It is the most complete isolated plant in this city, and reflects great credit on Mr. Driftmeyer as an able electrician, and also on Mr. W. F. Norton, the owner of the theatre, as he has spared nothing to make it the best that can be made. The engine and dynamo room is situated about 100 feet from the main building and contains one 80 h. p. Bass engine and a 60 h. p. Westinghouse. Two incandescent dynamos of 350 lights each and an arc machine of 50-light capacity for illuminating the grounds. The wires are carried overhead to the rear of the stage in a very substantial manner, and are now being painted with a waterproof mixture. The large switchboard is placed to the left of the stage, and contains many novel features, the work of Mr. Driftmeyer, for the quick and easy adjusting of light. There are two hundred 32 c. p. lamps on the stage, including the footlights, and 500 more are placed around the amphitheatre in a very artistic manner. F.

DETROIT, Mich., July 1, 1889.

Detroit International Exposition.—The lighting by electricity of the buildings and grounds of the International Exposition, to be held in this city on Sept. 17 to 27 next, will constitute a job of magnitude and importance. This is to be the largest exhibition held in the United States since electric lighting came into vogue. The grounds to be lighted by arc lights are seventy acres in extent. They will be bordered on the river front by long lines of wharves and boat landings, and on the other three sides by streets, with numerous entrances and exits, and thronged with people and vehicles, including horse, steam and electric cars, requiring many powerful lights. The buildings are of immense proportions and several in number, having halls, corridors, galleries, cells, rooms, alcoves, lofty transepts and naves, and many passageways, entrances and exits. They include an enormous art gallery, which will require special lighting arrangements; vast stock, show and feed buildings, with stalls, lofts and stables; and buildings and tents for machinery, music, refreshments, storage, and various uses; besides numerous smaller structures. The various buildings will cover nearly sixteen acres of ground. The main building is a gigantic structure, five hundred feet long by two hundred and seventy feet broad, and seventy feet high, with four great towers, the largest of which is two hundred feet high by sixty-one feet square, and the others one hundred and sixteen feet high by twenty-six feet square. The arches of the great nave are nearly seventy feet in height. The art gallery is one hundred and fifty feet front. The main building contains over six acres of glass for lighting. It is constructed of wood and glass, resting upon a substructure of brick and terra cotta, with entrances of cut stone, iron and brick. The cost of the buildings will be $250,000. Edison incandescent lights will be used in all the buildings. Estimates and plans are being prepared, and upon their completion the work of putting in the electric light plants will be placed in charge of a competent electric engineer. There will be various electric exhibits, some of them of a high order; but no effort is being made to make this a peculiar feature of this year's exhibition, the special competition of the great World Exposition in Paris being first in the field, and already having drawn so large a proportion of electric invention and manufacture, but enough will be shown to educate and stimulate the public for a great electric exhibition another year. B.

SAN DIEGO, Cal., June 11, 1889.

Geo. P. Low, the electrical contractor of San Diego, has been elected a member of the Common Council of that city.

Geo. D. Copeland has given a syndicate of Philadelphia capitalists a thirty days' option for the purchase of all the franchises of the San Diego Electric Rapid Transit Street Car Company, which are now controlled by Mr. Copeland.

Better Poles.—The authorities of the city of San Diego are about to enforce an ordinance passed last year, compelling the local electric lighting companies to take down their old poles in the business portion of the city, and to unite in the erection of the uniform forty-five-foot poles.

The San Diego Gas and Electric Light Company has purchased a 35-light Brush dynamo complete, with all accessories. The company's electrical equipment now consists of seven Indianapolis Jenney 30-light dynamos, one 100-light series incandescent dynamos of the same make, one Western Electric 30-lighter and one 65-light Brush machine.

A Change of Plant.—Since the installation of the Westinghouse plant in San Diego, the owners of the isolated plant in the Pierce-Morse block, deemed it a matter of economy to replace the Edison system with Westinghouse lights, and consequently the old Edison plant has been abandoned. The building was re-wired, and now the alternating system is used exclusively. The Edison outfit, however, did not remain idle long, for the entire equipment, consisting of two forty horse steel boilers, two thirty-five horse Westinghouse engines, two three hundred-light Edison dynamos, together with all the accompanying electrical equipment, has been sold to the Otay Watch Company, and will hereafter be used in the large four-story brick factory of that concern. Otay is a suburb of San Diego, and, in addition to lighting the factory, the plant will furnish current for commercial lighting purposes.

THE TELEGRAPH.

Long Branch.—Mr. Norman L. Munro, the publisher, proposes to run a new telegraph line from Long Branch to New York.

Landing Cables.—A special dispatch from Ottawa, Can., of July 4, says: "The Minister of Customs has ordered that facilities be given to land new cables in Dover Bay, N. S., for connection with the New York land lines. The cables include extensions of the two Western Union cables of 1881 between England and Canada, terminating at Canso. The new direct French cable has been landed at Fox Island, five miles from Canso."

Quotations Public Property.—A special dispatch of July 5 from Chicago says: The Board of Trade received a pretty hard rap this morning by the decision of Judges Horton, Tuley and Collins sitting *en banc* on the motion of the board's attorney to dissolve the preliminary injunction to prevent the board from withholding its quotations from the bucket-shops. The judges in their decision deny the motion to dissolve the injunction on the ground that the market quotations are of such importance to the public that they should be considered public property, and that if the injunction were dissolved the tendency would be to create a monopoly of the big board.

The American Morse Code Preferred —By a general order issued from Army Headquarters the American Morse code will hereafter be used by the army for all purposes of signaling, whether visual or acoustic, and the use of the English Morse, or Continental, code will be discontinued. This action was taken upon the recommendation of the chief signal officer with a view to the simplification of signal instruction, and to the ready employment and utilization in time of war for skilled civilian telegraphers for military purposes. Fewer errors are sppposed to result from the use of the English system, but it is slower than the American system, and its continuance would involve the employment of specially trained experts who could not be procured in sufficient numbers in an emergency.

Endorsing Paper by Telegraph.—A special dispatch from Kansas City of July 3 says: Judge Phillips, of the United States District Court, has prepared his opinion in the case of Garnett A. Garrettson against the North Atchison Bank, at Westboro, Mo., filed at St. Joseph. The case involves the question of the liability of an endorser who endorses commercial paper by telegraph. James Tate, of Colorado, proposed to buy of the Muscatine Cattle Company, of Iowa, 1,000 head of cattle for $22,000. The Cattle Company at the time owed the bank, and wanted it to take Tate's check on the bank for the purchase of the cattle in payment of the company's debt. They telegraphed, asking if it would pay Tate's check for $22,000. The bank answered by telegraph: "Tate is good. Send on your paper." The check finally fell into the hands of Garrettson, but upon sending it to the bank it was protested. Judge Phillips holds that the acceptance of the check as implied in the bank's telegraphic message amounted in the law to an endorsement, and the judge decides that the bank must pay the plaintiffs the amount.

THE TELEPHONE.

The Kentucky Union Railroad Company are building a telephone line along their road.

Georgia.—A company is beipg formed to operate a telephone line from Lincolnton to Washington.

The Government Telephone Suit.—A decision was given on July 2 by Judge Colt in the United States Circuit Court in the case of the United States against the American Bell Telephone Company and others. Plaintiff filed a motion for the appointment of an examiner to take testimony generally covering the case while Prof. Alexander Graham Bell, one of the defendants, also filed a motion for the appointment of an examiner to take testimony upon the issue raised by his plea filed in the case. The court denied the defendant's motion and granted that of the plaintiff, appointing Commissioner H. L. Hallett examiner.

Virginia.—A telephone line is projected from West Point, Va., to Walkerton, Va., 30 miles long. This line is to be used in connection with the Tidewater Telephone Company's line from West Point to Gloucester Court-House, with its branches, including about 110 miles of wire. The line from West Point to Walkerton will be extended to Richmond, Va., in a short time, making it about 48 miles long. It will be started with five stations. The line will be galvanized iron of the best quality and No. 10 Brown & Sharpe gauge, to be built by C. H. Richardson, of the West Point Water, Light and Power Company. The latter company has a nice Thomson-Houston plant, and Mr. Richardson, while in New York, recently, stated that the capacity will be increased in the fall.

THE ELECTRIC LIGHT.

Portia, Ark.—Peabody & Wells are putting electric lights in their lumber mill.

Danville, Ky.—It is proposed by the Danville Gas Company to put in an electric light plant.

Fall River, Mass.—The local Edison Company is enlarging, putting in a new engine, etc.

Jeannerette, La.—Mr. A. L. Mounot wishes to buy an incandescent plant of 60 lights for a sugar refinery.

Charleston, S. C.—The Charleston Electric Light and Power Company will run motor circuits, and is putting in a generator.

Sherman, Tex.—The Thomson-Houston Company will enlarge the lighting plant at Sherman and furnish power for an electric road.

The Elmira, N. Y., Gas Light Company have purchased a plant of the Schuyler Company, to be in operation by Aug. 1.

Frackville, Pa.—It is stated by Mr. J. Haupt, of the Mountain City Water Company, that proposals will be entertained for an electric light plant.

East Bridgewater, Mass., proposes to have an electric light plant. A company is being formed by Mr. R. O. Harris and others with a capital stock of $10,000.

Woodstown, N. J.—The Woodstown Light, Heat and Power Company has been formed with a capital stock of $25,000, and will put in a Thomson-Houston plant.

North Manchester, Ind., has an Indianapolis Jenney arc plant, put in by Mr. George Burdge. It starts with 14 lights, and the results are highly satisfactory.

The Mt. Vernon, O., Electric Light Company, running a Schuyler plant, have just declared their first dividend, having been in operation but about six months.

Ballston, N. Y.—The Ballston Electric Light and Power Company was incorporated recently with a capital stock of $10,000, by S. C. Medberry, H. J. Donaldson and others.

The Bryan, O., Electric Company, using the Schuyler system, have secured the city contract for lighting for 3 years. An increase of 50 lights will be made to the plant at once.

Nantucket, Mass.—The Nantucket Electric Light Company, P. A. Underwood, president, is putting in a Thomson-Houston plant of arc and incandescent lights, to be running early this month.

The Schuyler Company have a large force of men at work in Alexandria, Va., preparing circuits for their new plant recently sold to the Gas Company. The current will be turned on about Aug. 1.

Alaska.—The Alaska Electric Light and Power Campany has filed articles of incorporation in Oregon. Its capital stock is $300,000. Among those interested are C. E. Benn, F. O. Downing and A. Thomas.

Maracaibo.—The Maracaibo Electric Light Company has been formed to do lighting in Venezuela, by F. P. Villamizar, S. P. Triana, R. Fideau, A. M. Fuentes and others, with a capital stock of $100,000.

Unique Illumination.—There hangs suspended over the entrance to the Chicago office of the U. S. Express Company a gracefully tapering golden dragon, some 25 feet in length, with a seven-forked tongue darting from its widely distended jaws, and bearing on each tip a sixteen candle-power incandescent lamp, an incandescent lamp also illuminating each eye.

Large Belts for Electric Work.—Among the large belts now employed in electric lighting, that at the East River Electric Light Company's station, this city, deserves note. It was made by the Shultz Belting Company. It is 123 feet long, 58 inches wide, weighs 1,300 pounds and transmits 1,000 h. p.

Putnam, Conn.—The Putnam Light and Power Company is a consolidation of the Putnam Gas Light Company and the Putnam Electric Light Company. It will put in a new power plant at the gas-works. It has contracted for a 125 h. p. Hazelton boiler and a 600-light Thomson-Houston alternating machine, to replace the 200-lighter of the same make. It is furnishing 40 Thomson-Houston arcs for streets and stores. Mr. F. W. Perry is the president of the company and Mr. A. W. Bowen, secretary and treasurer.

Isolated Edison Plants.—Mr. F. R. Chinnock, Edison agent for Long Island and New Jersey, reports having been awarded a contract by the Tide Water Oil Company, of Bayonne, N. J., to instal 1,000 lights of 16 c p. The plant will comprise two Edison 500 lighters, and will be run on the three-wire system. This will be the largest oil works plant in the United States, and it will ramify over 300 acres of ground. He has sold a plant of 75 lights to the Pennsylvania Company for their Brooklyn ferry slip, and has a contract from the Brighton Incandescent Electric Light and Power Company, of Coney Island, to instal 1,500 lights and power for 12 carousels.

Cincinnati, O.—A special dispatch from Cincinnati of July 1 says: Robert P. Clapp and E. I. Garfield, two of Boston's leading capitalists, are said to have bought out the local electric lighting companies with a view to consolidating them under one company and management. Among the companies concerned are the Brush Electric Company, the Edison United Manufacturing Company, the Hauss Electric Lighting and Power Company and the Thomson-Houston Electric Company. The officers of the latter company deny that the consolidation has been agreed upon, but it is well known that the negotiations have been going on and are about completed.

The Thomson-Houston Electric Company reports the following sales: Toledo, O., 50 arc, 1,000 inc.; Auburn, N. Y., 100 arc; Augusta, Ga., 650 alt.; Providence, R. I., 150 arc.; Salem, Mass., 1,300 inc; Decatur, Ind., 50 arc; South Framingham, Mass., 30 arc; Pawtucket, R. I., 25 arc; Putnam, Conn., 400 inc.; Winooski, Vt., 50 arc; New Berlin, N. Y., 650 inc. And the following isolated plants: A. E. Burkhardt, Cincinnati, O., 400 inc.; G. H. Ross, Cincinnati, O., 100 inc.; G. E. Keeth, Campello, Mass., 50 inc.; Paul Cornell, Chicago, Ill., 350 inc.; City Milwaukee Water Works, Milwaukee, Wis., 125 inc.; Kansas State Sugar Company, Attica, Kan., 100 inc.; St. Louis *Republic*, St. Louis, Mo., 300 inc.; Columbus Electric Light and Power Company, Columbus, O., 50 arc, central station; Fresno Gas Company, Fresno, Cal., 50 arc, central station; Academy of Music, Chicago, Ill., 400 inc., 16 arc.

New York Lighting Bids.—The Gas Commission met in the office of Commissioner Gilroy on July 2, and opened bids for lighting the city by electricity. The bids received were as follows: Mount Morris Electric Light Company, 378 lamps at 20 cents each per night, 139 at 21 cents, 72 at 22 cents, 94 at 23 cents, 22 at 25 cents, and 32 at 46 cents. East River Electric Light Company, 38 lamps at 35 cents each, and 21 at 44 cents. Brush Electric Illuminating Company, 371 lamps at 35 cents, 70 at 45 cents. United States Illuminating Company, 282 lamps at 25 cents, 176 at 29 cents, and 334 at 35 cents. North New York Lighting Company, 26 lamps at 40 cents, and 3 at 60 cents. Harlem Electric Light Company, 49 lamps at 35 cents, 16 at 44 cents, 19 at 50 cents, and 2 at 60 cents. For lighting in the subway districts the only bids were these: Brush Company, 70 lamps at 45 cents; East River Company, 21 lamps at 44 cents, and Harlem Company, 16 lamps at 44 cents. These figures show reductions of from 20 to 25 cents. The board will meet again on July 9 and award the contracts.

APPLICATIONS OF POWER.

Newcomb, Tenn.—The Standard Coal Company propose to operate their mining machinery by electricity.

Middlesborough, Ky.—The Middlesborough Electric Street Railroad Company is being formed with a capital stock of $50,000.

North Adams, Mass.—The Fitchburg Steam Engine Company are furnishing the steam plant for the North Adams Electric Railway.

Wichita, Kan., has a Thomson-Houston generator of 40 h. p. which keeps as many as six heavy cars going, and some of them at 15 miles an hour.

The Silvey Electric Company, of Lima, O., is putting in an electric street railway on the overhead system at Moberly, Mo., also at Des Moines, Ia.

Knoxville, Tenn.—Mr. W. Morrow, of Nashville, a large owner of stock in the Knoxville street railways, proposes to operate them by electric motor.

Nashville, Tenn.—The City Electric Railway Company has been formed by I. T. Rhea, T. W. Wrenne, R. W. Turner, J. H. Bruce and P. G. Breen, and immediate work is proposed.

The Sprague Electric Railway and Motor Company, has filed a certificate at Albany for an increase of its capital from $1,000,000 to $1,600,000, of which $400,000 is to be preferred.

The Electric Traction and Manufacturing Company, of New Orleans, has been formed by W. J. Behan, M. J. Hart, T. Prudhomme, P. Thompson and others, with a capital stock of $1,000,000.

Mr. W. R. Kimball installed recently the first stationary motor of 10 h. p. in Canada. It is about 1,000 feet from the central station in Montreal and is employed in a plate glass factory. It is a Thomson-Houston machine.

West Orange, N. J.—The West Orange Township Committee has decided to light a part of that township with electricity, and ordered a contract to be made for one year with the Essex County Electric Company, of Orange, for 37 arc lamps, at a total cost of $3,600.

The American Workingmen's Expedition to the Paris Exposition leaves New York by the "City of Rome" on July 24. The expedition is sent out by the Scripps' League of Western newspapers, and will include about fifty representative American workingmen.

Kansas City.—The Thomson-Houston service on the Armourdale line of the Metropolitan Company will be in active operation early this month. The Vine street steam road is also to be operated by the Thomson-Houston system at an economy that may go as high as 70 per cent. on the present expenses of operation.

The Omaha Motor Railway Company, after two years' litigation and conflict with rival corporations, is nearly ready to be put in operation with the Thomson-Houston electric system. The largest power station which has as yet been constructed for electric railway operation is owned by this company, and the car equipment ranks second in quantity among electric railways yet constructed, it having 26 motor cars, all of which will be used to tow at least one additional tow car, and many of the motor cars will tow two additional cars. The success of the Thomson-Houston system on the Omaha & Council Bluffs line has made the citizens of Omaha jubilant at the immediate prospect of such rapid transit being given them over

their entire city. In addition to the equipment ready to be put in, the company intend to place 20 additional motor cars upon the extensions of its system within a few months.

PERSONALS.

Mr. Wm. Stanley, Jr., will, it is reported, shortly become a resident in the vicinity of New York, and have an experimental laboratory in the United States factory at Newark, now under Westinghouse control.

Mr. Rankin Kennedy notifies us that he has transferred his electrical business to the firm of M'Culloch, Sons & Kennedy, Limited, at Kilmarnock, Scotland. He will have greater facilities and will give electrical work his personal attention.

Mr. L. H. Rogers, well known in connection with the Electrical Accumulator Company, of this city, and an inventor whose ingenious devices we have more than once had occasion to call attention to, has received the appointment from the Brush Electric Company, of Cleveland, as their agent for the New England States, with headquarters in Boston. Mr. Rogers is distinctively a "pusher," and we have no doubt that his intelligent aggressiveness will soon make itself felt in the new and responsible sphere of labor to which he will soon betake himself.

MISCELLANEOUS NOTES.

Dallas, Tex.—It is reported that an electrical manufacturing concern in Cincinnati intends to remove to Dallas.

The Viaduct Manufacturing Company, of Baltimore, Md., has just issued a new catalogue and price list of telegraph, telephone, electric light and general electrical apparatus and supplies. It is a beautiful production, and is an encyclopædia of electrical wares. Its 88 pages are replete with illustrations, and all necessary information is furnished about the various lines and styles. The catalogue will be sent free of charge to any address upon application.

Lynchburg, Va.—Mr. C. P. Poole wishes to say with regard to his recent interesting little note on the Eickemeyer motor running a printing press, that he finds the ammeter readings to range from 5 to 18 ampères, and not 3 to 18, as he had previously stated. Even with this decrease in the variation of current, the record is a striking one.

The Ohio State University, Columbus, O., has been spending a special appropriation from the Legislature in the building and equipment of an electrical laboratory, to be ready by the fall term, beginning Sept. 11. The building is 45 by 75 feet, two stories high. The course of study covers four years, and those completing it receive the degree of mechanical engineer, their diplomas stating that they have completed the course in electrical engineering. Admission is obtained on the same conditions as to the other engineering courses in the university.

The St. John (N. B.) Electrical Exhibition, which will be held on July 22, is attracting a good deal of attention, and many of our readers will be interested to learn that all the necessary provisions have been made for admission of goods in bond. Parties who have sold their rights in Canada can, of course, arrange with their Canadian representatives for the right to exhibit, etc. The exhibition has already assumed very large proportions, and will undoubtedly be well attended. The International Steamship Company will run a special excursion from Boston to St. John, leaving Saturday evening, July 20.

Burton Electric Heaters.—During the past few weeks a series of very interesting tests have been made in heating a railway passenger coach, furnished by the Richmond, Fredericksburg & Potomac Railroad Company, by means of the Burton Electric heaters. These tests have been conducted by Mr. E. W. Trafford, electrical engineer and superintendent of the Virginia Electric Light and Power Company, of Richmond. Fourteen heaters, with a radiating surface of 70 square feet, were used. Mr. Trafford estimates that the current to warm a car for half an hour before it is attached to a train would cost 6 cents, and that the cost of maintenance after that would be 1½ cents per hour for fuel.

BUSINESS NOTICES.

City Gas Light Company, of Norfolk, Va., say that "Schieren's *perforated* belts are *by all* odds the *best* belt for dynamos they have ever used." Chas. A. Schieren & Co., manufacturers, New York, Boston, Philadelphia, Chicago.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, No. 3 South Warren street, Syracuse, N. Y.

The Underwood Manufacturing Company, of Tolland, Conn., have moved their New York office to 74 Cortlandt street, where their representative, Mr. O. H. Merrill, will be glad to consult with all who require their specialties in patent cotton leather belting, patent solid round belting, lacings, belt hooks, etc.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rods, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

The Brown & Sharpe Manufacturing Company, of Providence, R. I., have recently issued a neat and instructive pamphlet on the construction and use of their universal hand lathe. As some of the processes described in the pamphlet are unfamiliar to many machinists, it is one that should be widely read. Copies of it can be obtained gratis upon application.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED JULY 2, 1889.

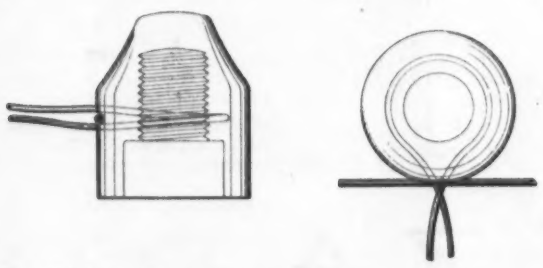
406,041. Insulator for Electric Wires; James C. Gill, of Covington, Ky., Assignor to the Hemingray Glass Company, of same place. Application filed March 6, 1889. A glass electric wire insulator through which a portion of the line wire is cast, in combination with the main wires. See illustration.

406,057. Electric Signaling Device; James C. O'Neil, of Cleveland, O. Application filed Sept. 29, 1888. A train approaching the crossing from either direction causes the signal to sound; but the same train at or near the crossing cuts out the signal device, so that it cannot sound while the train is passing away from the crossing.

406,130. Manufacture of Incandescent Electric Lamps; Thomas A. Edison, of Llewellyn Park, N. J. Application filed Aug. 11, 1886. The object of the invention is to so construct an incandescent electric lamp that the electrical carrying or transportation of carbon particles from the filament to the glass will be greatly diminished or entirely prevented. This is accomplished by coating the inner surface of the globe with a conducting material, viz., a thin transparent adhesive semi-liquid conducting film. The substance with which the glass is coated, is melted phosphoric anhydride containing just enough water to make it run over the glass. This is a transparent gummy substance and does not give off its water or any gases at the temperature to which the globe is raised in the use of the lamp. A piece of glass inclosing a piece of iron is placed in the globe, together with a piece of phosphoric anhydride, and the proper amount of water is added to the latter by means of a narrow glass tube passed through the exhaust tube of the lamp. The phosphoric anhydride is then heated by holding the globe over the lamp flame until it assumes a glossy appearance. Then by bringing near to the lamp the poles of an electro-magnet, the piece of glass and iron is moved into the mass of phosphoric anhydride, and then the piece of glass is moved all over the interior of the lamp, being brought back to the phosphoric anhydride for a fresh supply when necessary. A very thin coating is thus produced upon the glass of the lamp. The piece of glass and iron is then removed, and the lamp is ready for exhaustion.

(1) 406,168. Electric Battery; (2) 406,169. Electric Battery; Charles A. Hussey, of New York, N. Y. Applications filed (1) Nov. 17, 1888; (2) March 18, 1889. (1) In an electric battery employing a solution of salt of copper, the combination, with a cell and positive and negative elements, of a porous diaphragm arranged in the upper part of the cell below the positive element and a piece of metal which is arranged below the porous diaphragm and will decompose the salt of the copper solution. (2) In an electric battery designed for two fluids, a porous diaphragm for separating the two fluids and extending solely in a horizontal or approximately horizontal plane and having non-porous vertical walls.

406,172. Electric Registering Apparatus; John A. Lannert, of Cleveland, O. Application filed Dec. 20, 1886. In an electric registering apparatus, a registering surface having a



406,041. Insulator for Electric Wires.

separate column for each of the units, in combination with separate columns for each of the tens, and running in the direction that the registering surface is moved.

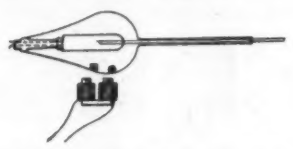
406,223. Galvanic Battery; John Ellwood Lee, of Conshohocken, Pa. Assignor to the J. Ellwood Lee Company, of same place. Application filed March 14, 1889. The combination of a battery cell having a cup electrode with a contact plate, having a grooved stem passing through the body of the cell and into the cup, and the metallic body mechanically securing the stem and electrically connecting it to the cup.

406,267. Insulating Plate for Secondary Batteries; Stanley C. C. Currie, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester, N. J. Application filed Feb. 18, 1889. A perforated corrugated insulating plate or diaphragm permitting of the free passage of the current as well as the free circulation of the liquid and gases in or through the perforation and around or along the grooves or recesses of the corrugations thereof.

406,268. Cut-Out; Stanley C. C. Currie, of Philadelphia, Pa., Assignor to the United Electric Improvement Co., of Gloucester, N. J. Application filed April 19, 1889. The invention consists in two wires or pieces of metal or other conducting material interposed in an electric circuit and suitably supported at one of their ends by a connecting device and with portions of the wires or pieces imbedded in an insulating substance or material of poor electrical conductivity, but susceptible of being melted at a low temperature, with portions of said wires or pieces immersed in a conducting fluid contained in a bulb or other suitable vessel. See illus.

406,284. Insulated Electric Wire; Henry Ward Johns, Jr., of New York, N. Y. Application filed Jan. 8, 1889. A wire for conducting electricity, having a practically seamless insulated covering made, essentially, of asbestos mechanically mixed with soapstone, plumbago or other similar material.

406,293. Combined Electric Bell and Annunciator; (2) 406,294. Electric Trembler Bell; James F. McLaughlin, of Philadelphia, Pa. Applications filed respectively (1) Feb. 2, 1889; (2) March 29, 1889. (1) The combination, with an electro-magnet, of an angle armature provided at its free end with a lug, a knuckle lever with one end in operative rotation to the lug, and



406,130. Manufacture of Incandescent Electric Lamps.

an indicator plate provided with a lug in direct operative relation to the other end of the lever. (2) An electric bell, consisting, essentially, of a bell, a vibratory polarized armature having like poles in operative relation to each polar terminal of the neutral electro-magnet, and a bell hammer or hammers carried by the armature.

406,306. Electrode for Therapeutic Body Wear; Harry P. Pratt, of Chicago, Ill. Application filed March 12, 1889. An electrode for use with electro-therapeutic body appliances and formed with flexible absorbent material, having a flexible metallic conductor secured to it.

406,331. Electric Coupling and Circuit Closer; William H. Baker, of Chicago, Ill. Application filed March 22, 1889. A spring bar of each section serves to lock the sections together and also to make the connections with the pin and close the circuit when the sections are separated, thereby dispensing with independent spring catches.

406,337. Magnetic Separator; Gurdon Conklin, of Glens Falls, Assignor to the Conkling Ore Dephosphorizing Company, of New York, N. Y. Application filed Nov. 15, 1888. The combination with a feed belt, a transverse belt, and a magnet or magnets contained in said transverse belt of a cover extending over the feeding section of the feed-belt.

406,354. System for Charging and Discharging Storage Batteries; William P. Kookogey, of Brooklyn, N. Y., Assignor to the Kookogey Electric Company. Application filed Aug. 25, 1888. The combination of a charging circuit, two storage batteries, a working circuit, two electro-depositing cells, each respectively forming a part of both the charging and discharging circuits of one of the storage batteries, and each of such depositing cells having one of its plates suspended from the arm of a balance beam so as to move up or down under the operation of the current through the cell, and a double alternating switch operated alternatively by the movement of the balance arms by which the storage batteries, automatically and alternatively with each other, are connected in circuit alternatively with the working line and with the charging source, the one to charge while the other is discharging.

406,377. Annunciator, Albion Alexander Vanderpool, of Newark, N. J. Application filed Oct. 4, 1888. In an annunciator, the combination of a centre shaft carrying an indicating hand or indicator, a cam having opposite inclines, and a series of arms adapted to engage said cam and revolve or turn the shaft and arm thereon, a slotted guide or holder and suitable means for operating the arms.

406,390. Electrical Typewriter; Mark W. Dewey, of Syracuse, N. Y., Assignor of two-thirds to Emil Laass and Charles H. Duell, of same place. Application filed Dec. 1, 1887. The objects of my invention are to print a message at a receiving station as fast as keys at the transmitting station are depressed, using independently movable type bars without necessitating the employment of isochronously moving wheels having the type affixed thereto, or without the necessity of waiting for mechanism to register accurately before printing, and the object is also to print the message typewriter style on a letter sheet, and to provide means of placing the carriage in any position and turning the platen with more ease and greater speed than an ordinary typewriter.

406,391. System of Electric Propulsion; Harvey D. Dibble, of Rochford, Dak. Ter. Application filed Feb. 2, 1889. In a system of electric propulsion for common roads, the wagon provided with drive wheels and a steering wheel having a vertical axis or shaft provided with a locking mechanism and a sprocket wheel, a vertical shaft between the drive and steering wheels, a sprocket wheel thereon, a chain connecting said sprocket wheels, a rod pivotally connected to the upper end of said second vertical shaft, and an electric motor, the shaft of which is geared to the axle of the drive wheels.

PATENTS EXPIRED JULY 2, 1889.

128,500. Improvement in Electro-Magnetic Passenger Registers for Street Cars, etc.; William H. Mumler, of Boston, Mass. Consists in the application of an electro-galvanic battery to a horse car or other vehicle, with suitable wires leading from said battery to a signal box containing electro-magnets, and thence to the steps of the car and connected to a suitable circuit closer thereon.

128,552. Improvement in Speaking Tube Annunciators; Robert May, of New York, N. Y. The invention consists in combining a drop ball or swinging plate, which is set in motion by air blown through the speaking tube, with a balanced lever, which serves to establish electric connection when moved by the displacement of the ball or plate.

128,604. Improvement in Printing Telegraphs; Thomas A. Edison, of Newark, N. J. An air-cushion applied to and combined with a printing lever and its magnet in a printing telegraph instrument.

128,605. Improvement in Printing Telegraphs; Thomas A. Edison, of Newark, N. J. A compound type wheel magnet and a compound printing magnet in a printing telegraph instrument in combination with a local constant circuit connected to one set of spools in such magnets, and the main line circuit connected to the other spools of such magnets.

128,606. Improvement in Printing Telegraphs; Thomas A. Edison, of Newark, N. J. A type wheel in combination with two actuating magnets and connections, one for operating a step-by-step motion one letter or division at a time, and the other for moving the type wheel two or more letters or divisions at a time.

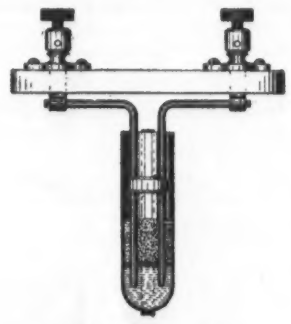
128,607. Improvement in Printing Telegraphs; Thos. A. Edison, of Newark, N. J. Two electro-magnets, one for operating the type-wheel lever, the other for giving the impression, both in the main circuit, in combination with a "shunt" or "cut-out" circuit and a shunt breaker.

128,617. Improvement in Lightning Rods; James W. Hankenson, of Minneapolis, Minn., Assignor to himself and Mohola Brawley, of same place. A lightning rod, made of an interior and an exterior copper shell, and provided with a zinc centre or core.

128,627. Improvement in Printing Telegraphs; John P. Humaston, of New York. Assignor to Edward A. Calahan, of Brooklyn, N. Y. Upon depressing a finger key the unison stop is mechanically withdrawn at the transmission station and a circuit broken so that the unison at the receiving instrument is withdrawn; thereby both type wheels start and rotate together.

128,660. Improvement in Galvanic Batteries; Joseph A. Robbins, of Medford, Mass., Assignor of one-half of his right to William B. Wortman, and one-quarter to Mrs. H. N. Harris, of Boston, Mass. The arrangement, within one battery jar, of two or more basicles or elements, constructed so as to nest within each other, all surrounding the porous cup, in which is placed a suitable number of carbon or equivalent elements.

128,662. Improvement in Combined Thermostat and Fire Alarm Signal-Box; Andrew Rosenbusch and Theodore William Kreitz, of Quincy, Ill. The combination, with a fire alarm indicator operating through the action of heat, of a means of operating the same manually.



406,268. Cut Out.

128,691. Improvement in Electro-Magnetic Burglar and Safe Alarms; Austin O. Wilcox, of Philadelphia, Pa. In combination, a continuous hollow-walled case, and two or more similar permutating commutators, having their separate motor-forces in established relation, operating to move their separate dependent registers in concord, and thereby preserving the circuit of an alarm, one or more of the register circuits being extended.

PATENTS EXPIRED JULY 9, 1889.

128,708. Improvement in Dial Telegraph Instruments; Stephen Chester, of Elizabeth, N. J. The combination of a wheel and revolving shaft passing through the centre thereof, but attached to each other only by an elastic spiral spring, or its equivalent, to open, close, or change currents of electricity.

128,818. Improvement in Lightning Rods; John C. Schoonmaker, of Winona, Minn. A lightning rod, constructed of a series of twisted copper and tubular wires.

128,894. Improvement in Telegraph Apparatus; George Little, of Rutherford Park, N. J. A metallic connection between one pole and the other at the operative end of an electro magnet to more rapidly disperse or neutralize the residual or induced magnetism.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.